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THESIS

IMPROVING THE TURKISH NAVY REQUIREMENTS DETERMINATION PROCESS: AN ASSESSMENT OF DEMAND FORECASTING METHODS FOR WEAPON SYSTEM ITEMS

by

Naim Teoman Unlu

December 2001

Thesis Advisor:	Kevin R. Gue
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13. ABSTRACT ***(maximum 200 words)***

Requirements determination is the process the Inventory Control Center Command (ICCC) uses to forecast future customer demands and to set levels of inventory to satisfy those demands. Demand forecasting is the essence of the Requirements Determination Process (RDP), which uses a forecasting model to predict demand. Then inventory models use this information to determine stock levels for every material. If forecasts and subsequent purchases are higher than actual usage, the result is excess inventory. If forecasts are lower than actual usage, the result is excessive backorders. Since excess inventory ties up money that could be used modernizing weapon systems, and since inadequate inventory can hamper critical systems as they wait for spare parts or repairs, forecasting future demands appropriately and setting inventory levels accordingly is highly important for an inventory management system.

The purpose of this thesis is to determine whether alternative methodologies offer better performance. We evaluate the current forecasting model that is used by the Turkish Navy and compare it with other forecasting methodologies.

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IMPROVING THE TURKISH NAVY REQUIREMENTS DETERMINATION PROCESS: AN ASSESSMENT OF DEMAND FORECASTING METHODS FOR WEAPON SYSTEM ITEMS

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Submitted in partial fulfillment
of the requirements for the degree of

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ABSTRACT

Requirements determination is the process the Inventory Control Center Command (ICCC) uses to forecast future customer demands and to set levels of inventory to satisfy those demands. Demand forecasting is the essence of the Requirements Determination Process, which uses a forecasting model to predict demand. Then inventory models use this information to determine stock levels for every material. If forecasts and subsequent purchases are higher than actual usage, the result is excess inventory. If forecasts are lower than actual usage, the result is excessive backorders. Since excess inventory ties up money that could be used modernizing weapon systems, and since inadequate inventory can hamper critical systems as they wait for spare parts or repairs, forecasting future demands appropriately and setting inventory levels accordingly is highly important for an inventory management system. In order to determine whether alternative methodologies offer better performance, we evaluate the Turkish Navy's current forecasting model and compare it with other forecasting methodologies.

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I. INTRODUCTION

A. BACKGROUND

The ultimate goal of the Turkish Navy is to maintain the highest combat readiness of its warfighters in order to defend the borders of its country and to support its allies. To maintain the operations of its combat forces, the Turkish Navy depends on a supply network composed of a main supply center, maintenance and supply depots, shipyards, and support activities, commercial manufacturers, vendors, and industrial resources. Its primary supply center maintains an inventory of almost 630,000 line items that consist of consumable spare parts, reparable components, subsystems, assemblies, equipment, general and special consumable materials, bulk items and maintenance kits. The main supply center and other stock points maintain this inventory to satisfy the material requirements of the operating fleet of ships and submarines, shore stations, and all associated weapon systems and related test equipment. Inventory is maintained at three levels:

- **Wholesale Inventory:** Material over which the wholesale inventory manager has visibility and control at the national level,
- **Retail Intermediate Inventory:** A level of inventory between the consumer and wholesalers to support a given geographic area, including area resupply and the three levels of maintenance (Organizational, Intermediate and Depot Maintenance), and
- **Retail Consumer Inventory:** Only the final user stores this level of inventory in an established supply distribution for the sole purpose of internal consumption or use.

An organization called Inventory Control Center Command (ICCC) manages the Turkish Navy's wholesale system. The ICCC was formed in 1994 to standardize inventory management procedures with a mission "to provide program and supply support for the weapon systems that keep our Naval forces mission ready." The ICCC's goal is to provide customers with quality products for the best value in a timely manner. Support for hull, electrical, mechanical, and electronic components and repair parts for ships, submarines, and weapon systems are among the duties performed by the ICCC. Inventory management in this context includes cataloging file preparation, identification,

standardization, requirements determination, procurement package development, and distribution management. The ICCC maintains visibility and control over materials located at stock points throughout the country through a system of on-line daily and monthly reports.

B. PROBLEM DESCRIPTION

Requirements determination is the process the ICCC uses to forecast future customer demands and to set levels of inventory to satisfy those demands. Demand forecasting is the essence of the Requirements Determination Process (RDP), which uses a forecasting model to predict demand. Inventory models then use this information to determine stock levels for every material. If forecasts and subsequent purchases are higher than actual usage, the result is excess inventory. If forecasts are lower than actual usage, the result is excessive backorders. Since excess inventory ties up money that could be used modernizing weapon systems, and since inadequate inventory can hamper critical systems as they wait for spare parts or repairs, forecasting future demands appropriately and setting inventory levels accordingly is highly important for an inventory management system. Currently, the ICCC is in the process of modernizing its inventory management system. This modernization offers an opportunity to upgrade the current forecasting models in the Turkish Navy's RDP in order to increase the effectiveness and efficiency of the Turkish Navy's inventory management system.

C. THESIS OBJECTIVE

Our objective is to evaluate the current forecasting model and compare it with the other forecasting methodologies to determine whether alternative methodologies offer better performance.

D. RESEARCH QUESTIONS

We seek answers to the following questions:

1. Primary Research Questions

- Are there alternative forecasting methodologies that offer better performance to predict future demand for weapon system items?
- If an alternative method exists and outperforms the current method, is implementing it feasible and cost-effective?

2. Secondary Research Questions

- How does the Turkish Navy currently predict the demand for its spare and repair parts at the wholesale level?
- How can we forecast demand if the demand for an item is very low or if there is very little historical demand?
- How can we eliminate the undesirable effect of unusual spikes in demand?
- What data do we need to forecast leadtimes? Does the Turkish Navy need additional data for its Weapon Management System (WMS) database?

E. SCOPE AND METHODOLOGY OF THESIS

We analyze the last eight quarters of wholesale demand data for weapon system items by obtaining requisition summaries from the WMS's requisition history file for items designated with country code "00" and "01." We first identify the forecasting methods that the Turkish Navy could use to predict future demand for its weapon system items. Second, we describe various measures of forecast errors used for monitoring forecasting performance. For forecasting procurement leadtimes and repair leadtimes we examine the current U.S. Navy procedures. We then introduce a methodology called "focus forecasting" and compare the current forecasting model with alternative stochastic forecasting models by choosing a specific statistical measure used for monitoring forecasting performance. During our analysis, we use a commercial forecasting software called STATLETS.

F. ORGANIZATION

Chapter II introduces existing stochastic forecasting models and the statistical performance measures that can be used to rank these models. Chapter III briefly describes the RDP and the current forecasting method that the Turkish Navy uses and then explains the existing U.S. Navy procedures used for forecasting demand and leadtimes for secondary items. Chapter IV compares the current forecasting model with alternative models using a statistical measure. Chapter V describes how to deal with intermittent and very low demand items and explains how to improve the forecasting process further by eliminating the undesirable effect of unusual spikes in demand. Chapter VI contains conclusions and recommendations.

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II. FORECASTING MODELS AND PERFORMANCE MEASURES

A. INTRODUCTION

A wide variety of models are available for use in different forecasting situations. Forecasting methods can be both qualitative and quantitative. Furthermore, quantitative methods can be grouped into deterministic models and probabilistic or stochastic models. In deterministic models the relationship between the variable being predicted and the variable(s) used to make the prediction is exact and known with certainty. On the other hand, in probabilistic or stochastic models, the relationship between the variable being predicted and the variable(s) used to make the prediction is not exact and is not known with certainty but is inferred from the past data. This chapter describes the stochastic models available for forecasting and the statistical measures that can be used to measure the performance of these models. These models are summarized from a vide variety of sources, which are listed in the bibliography. We focus our assessment of alternative methods on stochastic models since they are time-series models, which focus completely on the historical demand pattern to generate a forecast.

B. STOCHASTIC FORECASTING MODELS

This section provides a brief description of essential categories of stochastic models as well as general descriptions of individual models in the category and how they are formulated.

1. Simple Time-Series Models

Simple time-series models are considered unsophisticated because they use the basic assumptions on how future values of time series can be predicted with past values. The three models within this category are described in Table 1 [Ref 1].

Model	Formulation of Forecast
Basic Model	Forecast = actual value for last period
Basic Seasonal Model	Forecast for 1st period=actual value for last period Forecast for 2nd period= actual value for 2nd period Forecast for 3rd period= actual value for 3rd period, etc.,

	"Period" is the forecast period and the number of periods depends on the seasonality
Change Models	Forecast for next period = actual value for last period plus average change where; Average change= average of changes, Average change = average percentage change times last value, Average change= weighted average of changes

Table 1. Simple Time-Series Models

2. Smoothing Models

The smoothing models assume that the time series consists of a level pattern plus fluctuations caused by randomness. Models in this category attempt to smooth out the fluctuations by smoothing or averaging them. Like the simple models, these models are easy to use and relatively easy to understand. The three main models in this category are described below.

a. Moving Averages

Moving averages for a chosen period of length *L* consist of a series of arithmetic means computed over time, such that each mean is calculated for a sequence of observed values having that particular length. For example, a four-month moving average is found simply by summing the demand during the past four months and dividing by four. With each passing month, the most recent month's data are added to the sum of the previous three months' data, and the earliest month is dropped. This tends to smooth out the short-term irregularities in the data series.

Mathematically, the moving average, which serves as an estimate of the next period's demand, is

$$Moving\ Average = \frac{\sum demand\ \ in\ \ previous\ \ n\ \ periods}{n} \qquad (2\text{-}1)$$

where

n = the number of period in the moving average.

b. Weighted Moving Averages

One drawback of the moving average technique is that all the past data used in calculating the average are weighted equally. However we can often obtain a more accurate forecast by assigning different weights to data. One possible variation, known as "weighted moving averages," involves selecting different weights for each data value and then computing a weighted mean as the forecast. Generally the most recent observation receives the most weight, and the weight decreases for older data values. Mathematically, the weighted moving average (WMA) is

$$\text{WMA} = \frac{\sum (\textit{weight for period } n)\,(\textit{demand in period } n)}{\sum \textit{weights}}. \qquad (2\text{-}2)$$

c. Single-Exponential Smoothing (SES)

Exponential smoothing is a statistical method of forecasting the future based on the idea that as data becomes older it becomes less relevant and should be given less weight. SES uses actual data and deviations of previous forecasts to establish a projection of demand for the future. The number of previous periods selected and weight applied to each period in terms of an exponential relationship is set by the planner by selecting a constant α. A higher α gives greater weight to more recent periods. For example, $\alpha = 0.20$ assigns a 20 percent weight to the most recent period, while $\alpha = 0.50$ assigns a 50 percent weight. The basic exponential smoothing formula is

$$\text{New Forecast } (F_t) = (F_{t-1}) + \alpha\,[\,(A_{t-1}) - (F_{t-1})], \qquad (2\text{-}3)$$

where

α is a weight (or smoothing constant) that has a value between 0 and 1, inclusive,

F_{t-1} = last period's forecast,

A_{t-1} = last period's actual demand, and

F_{t-1} = last period's forecast.

3. Linear Trend Models

The linear trend models assume that the time-series consist of an upward or downward trend pattern plus fluctuations from randomness. The two models in this

category, which are more complex than the simple or smoothing models, are described below.

a. Linear Regression

Linear regression assumes a dependent variable is linearly related to an independent one. It then finds the equation of the line-of-best fit through the data. Mathematically, it is

$$Y(t) = \alpha + \beta\ t, \tag{2-4}$$

where

t= time index.

The parameters alpha and beta (the "intercept" and "slope" of the trend line) are usually estimated via a simple regression in which Y is the dependent variable and the time index t is the independent variable.

The least square estimates of the coefficients α and β are the values for which the sum of squared discrepancies is a minimum. It can be shown that the resulting estimates are

$$\beta = \frac{N * \sum(X * Y) - \sum X * \sum Y}{N * \sum X^2 - (\sum X)^2}, \tag{2-5}$$

$$\alpha = \text{Mean (Y)} - \beta\ * \text{Mean (X)}, \tag{2-6}$$

where

N= number of observations.

b. Double Exponential Smoothing (Holt's Method)

Single exponential smoothing is often referred to as first-order smoothing, and trend adjusted smoothing is called "second-order," or "double smoothing." As with any moving average technique, simple exponential smoothing fails to respond to trends. A more complex exponential smoothing model that adjusts for trends can be considered. The idea is to compute a single exponential smoothing forecast and then to adjust for positive or negative lag in trend. The formula is

Forecast including trend (FIT_t)= new forecast (F_t)+trend correction (T_t).

To smooth out the trend, the equation for the trend correction uses a smoothing constant, β, in the same way the simple exponential model uses α. T_t is computed by

$$T_t = (1-\beta)T_{t-1} + \beta(F_t - F_{t-1}), \qquad (2\text{-}7)$$

where

T_t = smoothed trend for period t,

T_{t-1} = smoothed trend for preceding period,

β = selected trend smoothing constant,

F_t = simple exponential smoothed forecast for period t, and

F_{t-1} = forecast for previous period.

The value of the trend smoothing constant, β, resembles the α constant in that a high β is more responsive to recent changes in trend. A low β value gives less weight to the most recent trends to smooth out the trend present. Values of β can be found by the trial-and-error approach, with the Mean Absolute Deviation (MAD) used as a measure of comparison.

4. Nonlinear Trend Models

The linear trend models attempt to fit data to a straight line that is a graph of a linear trend. The nonlinear trend models attempt to fit the data to other curves, which are not linear trends. If F represents the forecast, t the time period, and a, b, and c the parameters, we have the following curves and their associated forecasting models:

- Inverse Linear $F = a/t + b$ (2-8)
- Exponential Curve $F = b \exp(at)$ (2-9)
- Compound Growth $F = b\, a^t + c$ (2-10)
- Modified Exponential $F = b\, t^a + c$ (2-11)
- Logistic $F = 1 / (b\, a^t + c)$ (2-12)

A number of other curves that are combinations of the above also exist.

5. Decomposition Method

The underlying assumption in the decomposition method is that the data pattern comprises four components: a trend component (T), a seasonal component (S), a cyclical component (C), and a random component (R). The decomposition method attempts to isolate these components in the historical time series and then recombines them into a forecast for the future.

There are two general forms of time series models in statistics. The most widely used is a multiplicative model, which assumes that demand is the product of the four components. It is stated as:

$$\text{Demand} = T * S * C * R. \tag{2-13}$$

An additive model adds the components to provide an estimate:

$$\text{Demand} = T + S + C + R. \tag{2-14}$$

6. Box-Jenkins Method

The Box-Jenkins Method is not an actual model but is an approach to forecasting complex situations in which the data pattern is not evident. The steps that will be followed in this method are deciding the types of models to consider, identifying which models will fit the data, estimating the necessary coefficients (of the models), and diagnosing the model [Ref 2].

Developing the Box-Jenkins method is complex and a thorough knowledge of its use requires higher-order mathematics likely beyond that of forecasting specialists. Even though this method is complicated, the growth in computer power has made it feasible.

Three types of models use the Box-Jenkins method:

a. Auto-Regressive Model (AR)

The AR model postulates that the current value of a variable is the weighted linear sum of past values plus some error term. For example, an auto-regressive model of order 1- termed AR(1):

$$Y_t = b_0 + b_1 + Y_{t-1} + e_t, \tag{2-15}$$

where

Y_t = dependent variable,

Y_{t-1} = one period lagged dependent variable,

b_0 = constant term,

b_1 = regression coefficient, and

e_t = error term that represents random events not explained by the model.

b. Moving Average (MA)

The MA model postulates that the current value of a variable is a weighted linear relationship of past error terms and the current random term. For example, a moving average model of order 1- termed MA(1):

$$Y_t = e_t - W_1 e_{t-1} + b_0, \quad (2\text{-}16)$$

where

Y_t = dependent variable,

W_1 = weight,

e_t = error term that represents random events not explained by the model,

e_{t-1} = one period lagged error term, and

b_0 = constant term.

c. Integrated Auto-Regressive Moving Average (ARIMA)

The ARIMA model postulates that the current value of the variable is the combination of the AR and MA models. For example, ARIMA (1,0,1):

$$Y_t = b_0 + b_1 + Y_{t-1} - W_1 e_{t-1} + e_t. \quad (2\text{-}17)$$

7. Combined Forecasts

Data patterns often exhibit both trend and randomness or two or more other attributes. Since different models work better with different data patterns, limiting a forecast to a single model in this case may not produce a good forecast. Using an average of two or more forecasting techniques may be better than using a "wrong" model or a single poor forecasting model [Ref 3].

Unless strong evidence indicates a particular forecasting model is better than other models for a given data pattern, combining the output from several models might be desirable. A combined forecast is less sensitive to the specific choice of models, and it uses more information about the data pattern than a single model. The potential for large errors is reduced because the forecast is not built on a single set of assumptions. Therefore, it is safer and less risky than relying on a single model [Ref 3].

Some of the cheapest or more easily understood methods are

- The Basic Model and an Eight-Quarter Moving Average,
- The Basic Seasonal Model and an Eight-Quarter Moving Average,
- The Basic Seasonal Model and Single-Exponential Smoothing, and
- The Basic Seasonal Model, Eight-Quarter Moving Average and Regression Model.

C. STATISTICAL MEASURES OF FORECAST ERROR

Previous studies of forecasting methods have used two approaches to rank them. One approach uses statistical measures such as the mean-squared error, or mean-absolute deviation for ranking. Another approach creates a model of the inventory system and produces measures of cost and supply performance [Ref 4]. We prefer to use statistical measures for ranking because other approaches require us to build an inventory system simulation, which is complicated and beyond the scope of this thesis.

Ideally, we want the model that will give us the least error in the forecast. The problem is that several statistics exist for measuring forecast error. At this point we want to distinguish between bias and accuracy in forecasting. If we look at the differences over time, we are measuring the bias of the model, that is, we are determining whether it is overforecasting (negative sum) or underforecasting (positive sum). If we look at the size of the differences disregarding whether they are negative or positive, we are measuring accuracy. We support measuring accuracy because we believe that in inventory management, an overforecast is just as undesirable as an underforecast [Ref 3].

Using actual demand for a period D_i and forecasted demand for the same period F_i, we can compare the differences over some number of periods n in terms of some statistical measures. These statistical measures [Ref 5], which can be used to measure

forecast error, are described below. The first two statistics, mean error and mean-percentage error, measure bias while the others measure accuracy.

1. Mean Error (ME)

ME is simply the average of the total differences between the actual demands and forecasted demands. Mathematically it is expressed as

$$\text{ME} = \frac{\sum_{i=1}^{n}(D_i - F_i)}{n}. \tag{2-18}$$

2. Mean-Percentage Error (MPE)

MPE is the average of all of the percentage errors between the actual demands and the forecasted demands. Mathematically it is expressed as

$$\text{MPE} = \frac{100}{n}\sum_{i=1}^{n}\frac{(D_i - F_i)}{D_i}. \tag{2-19}$$

3. Mean-Square Error (MSE)

MSE is the average of the square of the differences between the actual demands and the forecasted demands. Mathematically it is expressed as

$$\text{MSE} = \frac{\sum_{i=1}^{n}(D_i - F_i)^2}{n}. \tag{2-20}$$

4. Mean-Absolute Deviation or Mean-Absolute Error (MAD or MAE)

MAD is the sum of the absolute values of the differences between the actual demands and the forecasted demands, divided by the number of periods of data *n*. Mathematically it is expressed as

$$\text{MAD} = \frac{\sum_{i=1}^{n}\left|D_i - F_i\right|}{n}. \tag{2-21}$$

5. Mean-Absolute Percentage Error (MAPE)

MAPE is the average of the sum of all absolute values of the percentage errors between the actual demands and the forecasted demands. Mathematically it is expressed as

$$\text{MAPE}=\frac{100}{n}\sum_{i=1}^{n}\left|\frac{D_i-F_i}{D_i}\right|. \tag{2-22}$$

III. REQUIREMENTS DETERMINATION PROCESS AND DEMAND FORECASTING

A. REQUIREMENTS DETERMINATION PROCESS (RDP)

Requirements determination is the process by which the supply system forecasts future customer demands and sets levels of inventory to satisfy those demands. The objective of the requirements determination process is to provide a high level of supply support at the lowest possible cost. To do so may mean stocking slow-moving items as well as fast-moving items. Requirements determination starts with forecasting a customer's needs and a supplier's resupply times. Those forecasts are the basis for determining whether to manage an item as stocked or nonstocked and, for stocked items, how much to stock [Ref 3].

Different procedures and mathematical models are available for determining both the initial and the replenishment requirements of spare and repair parts. Since these procedures and models are beyond the scope of this thesis, they are not covered here, but we do identify and explain the forecasting models and procedures that are used within the RDP.

B. FORECASTING AT THE ICCC

Currently the forecasting program used at the ICCC evaluates the last eight quarters wholesale demand data and produces a demand forecast for the next four quarters using the eight-quarter weighted moving average model. Since this model needs at least eight quarters of demand data for evaluation, forecasting is not performed during the demand development period, which is limited to two years after the initial provisioning. During this period, instead of performing a forecast for each item, the contractor determines a default value. This value is based on an item's technical replacement factor and the planned use of an end-item. The forecasting model, which is used after the demand development period, gives each quarter's demand a different weight beginning with 5% for the first two quarters, continuing with 10% for the third and fourth quarter, 15% for the fifth and the sixth quarter, and finally 20% for the most recent two quarters. After forecasting the demand, the total forecasted demand for the

next four quarters is compared to the wholesale stock level (which is expressed as "On-hand Inventory + Due-In – Backorders") in order to determine whether the projected demand is above the stock level or not. If the forecasted demand is above the stock level and if there is no planned replenishment to meet this demand, the item manager evaluates the item manually by looking at the quarterly demand graphs and the calculated forecasts for the next four quarters. Then the item manager either accepts the forecasted demand or decides upon a new forecast quantity. Since manual intervention by the item manager is time consuming, the demand-forecasting module is run once a year [Ref 6].

At the ICCC, no forecasting is performed for procurement leadtimes. Even though the order dates are recorded for all the items when the orders are made, receiving dates are not complete and accurate. Since item managers cannot keep track of the procurement leadtimes, they use a default value of one year for every item. Item managers determined this value by observing a set of 720 orders, which includes different types of items, within a period of two years [Ref 6].

In addition, no forecasting is performed for repair times because existing inventory models used at the ICCC do not consider a separate model for repairable items [Ref 6].

C. FORECASTING IN UNIFORM INVENTORY CONTROL PROGRAM (UICP)

The US Navy uses UICP to manage its wholesale inventory. UICP is basically a legacy system that includes computer programs and files, which had been developed to help the item managers determine the wholesale system requirements and manage the inventories of secondary items [Ref 7].

The UICP replenishment process is comprised of data gathering applications, files, requirements determination applications and Automated Data Processing Program products. Forecasting is performed by the Cyclic Levels and the Forecasting (D01) application, which is one of the requirements determination applications [Ref 7]. The models and procedures used in the UICP at Navy Inventory Control Point (NAVICP) Mechanicsburg to forecast the demand and the leadtimes of secondary items are described below:

1. Forecasting Demand and Standard Deviation of Demand

Either a four-quarter moving average model or a single-exponential smoothing model is used for forecasting demand at the NAVICP Mechanicsburg. Forecasting begins with a process called the "filter step." This process is designed to detect significant decreases or increases in quarterly demands. This is done to bring the demands to the attention of the item manager and to determine when to discard all data other than the most recent history of demand and to restart the forecasting process. Upper and lower limits are established to determine whether the observed demand is in-filter or not. The mathematical equations for computing the upper and lower limits at NAVICP Mechanicsburg are shown in Table 2 [Ref 8].

Limits	DLRs and Marks II and IV	Marks 0, I and III
Lower Limit	$\hat{D}_n - 3\hat{S}_{D,n}$	0
Upper Limit	$\hat{D}_n + 2\hat{S}_{D,n}$	Max $\{3\hat{D}_n, 5\}$
$\hat{D}_{n=}$ Computed demand forecast for quarter n $\hat{S}_{D,n}$ = Standard deviation of worldwide demand for quarter n = 1.25 $MAD_{D,n}$		

Table 2. Lower and Upper Filter Limits

As a result of these computations, if the observed demand is in-filter then the "Trend Testing Process" begins. This process uses a Kendall "*s*" statistic to test the trend. If there is more trend than the threshold value, the NAVICP Mechanicsburg uses a four-quarter moving average model to forecast demand. If there is less trend than the threshold value, the NAVICP Mechanicsburg uses a single-exponential smoothing model with α=0.1. If the demand is in-filter, the NAVICP Mechanicsburg uses the mathematical equations that are summarized in Table 3 [Ref 8].

If there is a trend	If there is no trend
$\hat{D}_{n+1} = \alpha D_n + (1-\alpha)\hat{D}_n, \quad \alpha = 0.1$	$\hat{D}_{n+1} = \frac{(D_n + D_{n-1} + D_{n-2} + D_{n-3})}{4}$
$MAD_{D,n+1} = \alpha \left\lvert \hat{D}n - Dn \right\rvert + (1-\alpha)\, MAD_{D,n}$	
$\hat{S}_{D,n+1} = 1.25\, MAD_{D,n+1}$	$\hat{S}_{D,n+1} = \sqrt{\frac{\sum_{i=1}^{n}(Di - \bar{D})^2}{n-1}}$

Table 3. In-filter Demand Equations

If the observed demand is not in-filter, then the program waits for one more quarter and keeps the same computed forecasts for both the demand and the standard deviation of demand. If the observed demand is not in-filter for the second time, then the forecasting process restarts. In that situation, the four-quarter moving average model is used for forecasting demand and the standard deviation of demand is calculated as follows:

$$\hat{S}_{D,n+1} = 1.7125\, (\hat{D}_{n+1})^{0.717}. \qquad (3\text{-}1)$$

2. Forecasting Leadtimes

Average procurement leadtime (PCLT) and production leadtime (PLT) for the quarter are computed by the Cyclic Levels and Forecasting (D01) application. This process is described below [Ref 8].

a. First Step

Forecasting begins with a filtering process, which filters the observations in order to determine whether the observation will be added to the cumulative leadtime or not. An observation is in-filter if

$$0.5\, \hat{L}_n < L_{obs} < 2\, \hat{L}_n, \qquad (3\text{-}2)$$

where

$\hat{L}_n$=Previously forecasted leadtime, and

L_{obs}= Observed leadtime.

In-filter observations are stored cumulatively to be used at the end of the quarter.

b. Second Step

This step is performed to calculate the average leadtime. It is computed as follows:

$$\bar{L}_n = \frac{Cumulative \quad total \quad days \quad in \quad the \quad lead \quad times}{Number \quad of \quad different \quad PCLTs \quad recorded} \text{ x} \frac{1}{91}, \qquad (3\text{-}3)$$

where

$\bar{L}_n$ = average leadtime for quarter n.

c. Third Step

Once $\bar{L}_n$ is computed, in order to find the new forecast for the leadtime, it is exponentially smoothed together with the old forecast. It is computed as follows:

$$\hat{L}_{n+1} = \alpha \bar{L}_n + (1-\alpha) \hat{L}_n, \qquad (3\text{-}4)$$

where

$\hat{L}_{n+1}$ = leadtime forecast for quarter n+1, and

$\hat{L}_n$ = forecasted leadtime for quarter n,

α = 0.2 if the previous observation occurred 1 or 2 quarters ago; 0.5 if the previous observation occurred 3 or 4 quarters ago; and 1 if the previous observation occurred 5 or more quarters ago.

d. Fourth Step

This step is performed in order to compute the standard deviation for PCLT. Initially, MAD is forecasted using exponential smoothing or a nonlinear regression approach depending on the value of smoothing constant. If the value of the smoothing constant is 1, then NAVICP Mechanicsburg does not use exponential smoothing. When exponential smoothing is used, MAD is calculated as follows:

$$MAD_{pclt,\,n+1} = \alpha\left|\bar{L}_n - \hat{L}_n\right| + (1-\alpha)MAD_{pclt,n}. \quad (3\text{-}5)$$

When the nonlinear approach is used, MAD is calculated as follows:

$$MAD_{pclt,\,n+1} = 0.051(\hat{L}_{n+1})^{0.884}. \quad (3\text{-}6)$$

Finally the estimated standard deviation for PCLT ($\hat{S}_{pclt,\,n+1}$) is computed as follows:

$$(\hat{S}_{pclt,\,n+1}) = 1.25\ MAD_{pclt,n+1}. \quad (3\text{-}7)$$

D. SUMMARY AND COMMENTS

This chapter briefly described the RDP and the forecasting method that the Turkish Navy uses. Additionally, the current U.S. Navy forecasting procedures were explained in the belief that the Turkish Navy might be able to use these procedures for its PCLT and PLT forecasting.

At the ICCC, only one forecasting model - namely an eight-quarter weighted moving average model with different weight assigned to each quarter demand - is used without considering whether the demand is observed in one quarter or in more than one quarter and whether a trend exists or not. If there is no trend, in other words, if the demand for every quarter is almost stable, then we expect this model to perform well. But if there is only one demand in an eight-quarter period or there are fluctuations in demand or the demand has a seasonal pattern, then we do not expect this model to perform well. As explained in Chapter II, different models work better with different demand patterns, leading us to choose the most appropriate forecasting model for each item.

Additionally, in order to increase the effectiveness and efficiency of the inventory management system, we should decrease the manual intervention of the item managers to the lowest level by establishing an automated forecasting methodology and a control mechanism that is managed by exceptions. In this way, item managers can use their time more efficiently since they can concentrate on important matters that need more attention than others.

IV. METHODOLOGY AND THE ANALYSIS OF DEMAND DATA

A. INTRODUCTION

In this chapter we initially present our proposed methodology called "focus forecasting"[Ref 9]. We also explain our analysis by giving specific examples, which are chosen randomly within the actual demand data. In order to show that using only one forecasting method for all items is an ineffective way and to show that our proposed methodology is more accurate than the current one, we used the Turkish Navy's last eight quarters of actual demand data and compared the proposed methodology to the current methodology. While analyzing the data, we used a commercial forecasting program, called STATLETS, and Microsoft Excel® to perform the test. Since we had an academic version of the software, we had to examine each item individually. Using the same program to examine all the items at one time is possible if the program is modified to run automatically for all the items while keeping the same logic.

B. METHODOLOGY

"Focus forecasting" employs various techniques to select the best model among these techniques. In this process "best" is determined by some measure of forecast error. Since our goal is to choose the best forecasting model whose result provides the greatest accuracy, we decided to use the "focus forecasting" as our methodology (Figure 1).

Here we selected the MSE to evaluate the forecasting model performance since it is not biased and it measures accuracy. Sanders (1997) also recommends using MSE to measure forecast accuracy in inventory control [Ref 10]. He recommends the MSE because it emphasizes large forecast errors. Even if two models have the same sum-of-absolute errors, one model may have consistent differences and the other may have both smaller and larger differences. The one with consistent differences is desirable because for any single period, there is a lower risk of making a large mistake.

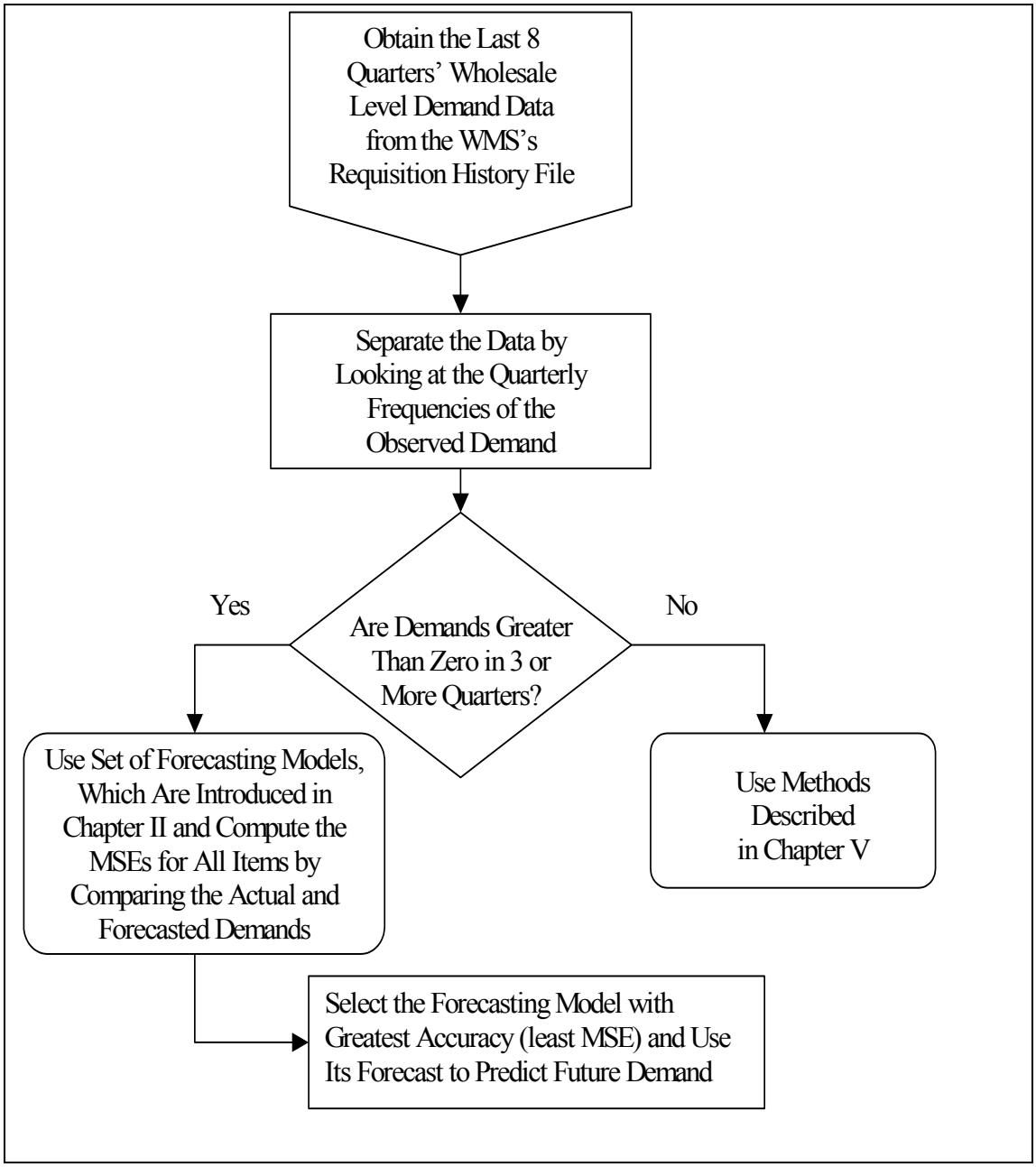


Figure 1. Proposed Demand Forecasting Methodology

We propose this model for the items whose demand is greater than zero in at least three quarters during a period of eight quarters. We make this proposal for two reasons: First, with one or two observations, the data will not fit into the statistical models, which are introduced in Chapter II, and the forecast derived from this sparse time series would

be questionable. Second, if there is no demand during six or seven quarters, and if we still continue to use the models, the result would be a biased forecast because of the observed zero demands during many quarters. We will discuss this issue fully in the next chapter. We define these infrequently demanded items as Intermittent (Low Demand) and Insurance Items at this point.

Additionally, we decided to base our analysis on the actual demand data of the last eight quarters. We did this believing that the data would include the trend, seasonal, and cyclical aspects of the time series pattern, all of which influence the selection and the performance of the forecasting model.

C. DEMAND DATA

We collected the last eight quarters wholesale level demand data from the WMS's requisition history file for the weapon system items, which were designated with country code "00" and "01." Since the data was not organized, we had to convert it into a meaningful format so that it could be used with STATLETS. Because of that we used the program in Appendix-A. After that, we separated the data into quarterly demands, based on their quarterly requisition frequency. Table 4 summarizes the number of items and their quarterly frequencies.

As understood from Table 4, most of the items were demanded in one or two quarters. This was not surprising because a previous study of 45,701 consumable items managed by the U.S. Navy Ships Part Control Center also showed similar results, namely, that 23,664 (51.8%) items had demand rates of less than one per year [Ref 11].

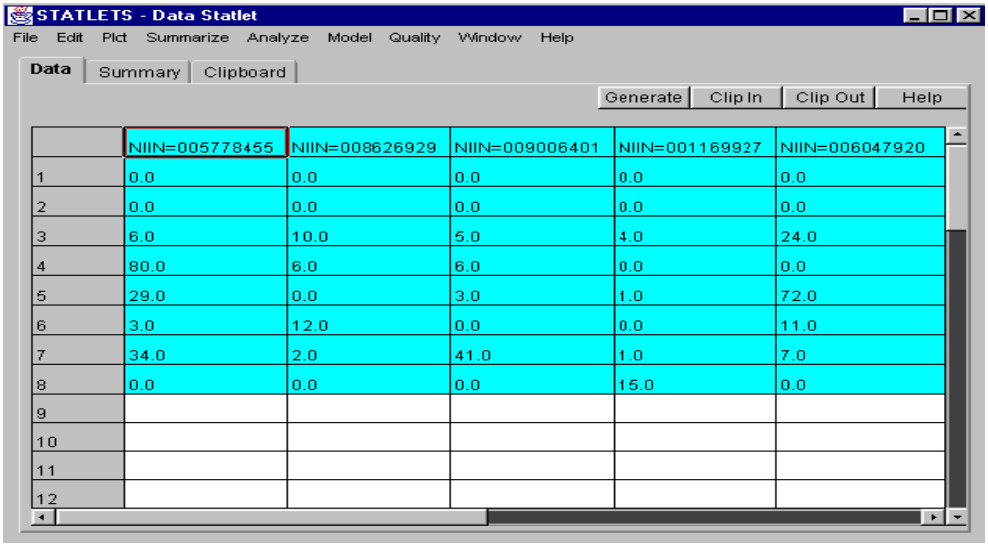
# of Quarters in Which the Observed Demand >0	# of items	% of Total Items
One Quarter	14,715 items	68.70
Two Quarters	4,087 items	19.08
Three Quarters	1,578 items	7.37
Four Quarters	632 items	2.95
Five Quarters	290 items	1.35
Six Quarters	85 items	0.40
Seven Quarters	23 items	0.11
Eight Quarters	8 items	0.04

Table 4. Number of Items Based on Quarterly Demand Frequencies

Finally, we separated the items whose demand was greater than zero in at least 3 quarters and randomly chose 1,600 of the 2,500 total items to reduce the analysis workload.

D. ANALYSIS OF THE DEMAND DATA

STATLETS is one of the commercial-off-the-shelf programs designed to perform statistical analysis, including sample size determination, regression analysis, time series analysis and forecasting. In order to analyze our data, we used one of the STATLETS' modules that is designed for time series analysis and forecasting. We simply began our analysis by plugging the last eight quarters actual demand data into STATLETS' data input screen. Figure 2 shows the data input screen of the program.



	NIIN=005778455	NIIN=008626929	NIIN=009006401	NIIN=001169927	NIIN=006047920
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	6.0	10.0	5.0	4.0	24.0
4	80.0	6.0	6.0	0.0	0.0
5	29.0	0.0	3.0	1.0	72.0
6	3.0	12.0	0.0	0.0	11.0
7	34.0	2.0	41.0	1.0	7.0
8	0.0	0.0	0.0	15.0	0.0
9					
10					
11					
12					

Figure 2. STATLETS' Data Input Screen

After we entered the data into the program, we used the Time Series Analysis and Forecasting Models under the Model's drop-down menu. The program allowed us to select the item we wanted to analyze, to determine what the sampling interval would be, and to determine what the number of periods for future forecasting would be. At this point all the computations are made automatically. Figure 3 shows the Forecasting Model screen.

Since the program allows us to select the models we want to compare, we decided to select from a set of models that are introduced in Chapter II. The models we chose are as follows:

- Linear Trend,

- 4-Quarter Simple Moving Average,
- Simple-Exponential Smoothing (α is optimized by the program),
- Holt's Linear-Exponential Smoothing (α and β are optimized by the program),
- ARIMA (1,0,0) with constant,
- ARIMA (0,0,1) with constant,
- ARIMA (0,1,1) with constant, and
- Constant Mean.

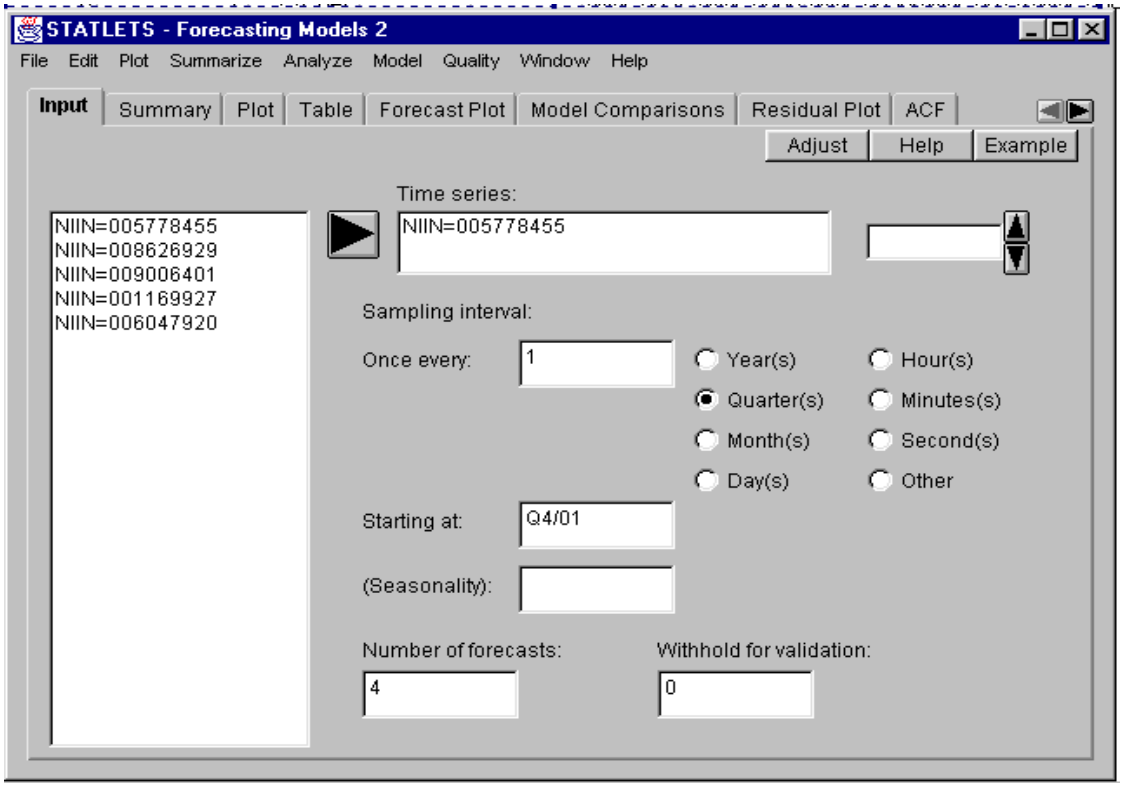


Figure 3. STATLETS' Forecasting Models Screen

To illustrate how the program works, we provide an example item and show the output of the program. We choose the first item (NIIN=005778455), seen in Figure 2 and Figure 3, as our example and we summarized the demand pattern in Table 5 again.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
0	0	6	80	29	3	34	0
Item Name		LAMP, INCANDESCENT			Unit Price	17.97 USD	

Table 5. Item NIIN=005778455 Quarterly Demands

For this specific item, the program automatically calculates the MSEs for all selected models and then ranks these models by looking at their MSEs. Table 6 summarizes the forecasting models and their associated MSEs.

Model Ranking	Forecasting Model	Calculated MSE
(1)	ARIMA (0,0,1) with constant	445.853
(2)	4-Quarter Simple Moving Average	517.953
(3)	Linear Trend=-257.964+1.30952t	685.247
(4)	ARIMA (1,0,0) with constant	692.305
(5)	Constant Mean=19	694.25
(6)	Simple-Exponential Smoothing, α=0.1064	798.354
(7)	ARIMA (0,1,1) with constant	902.861
(8)	Holt's Linear Exponential Smoothing with α=0.3694 and β=0.3524	1165.39

Table 6. Forecasting Models and MSEs for NIIN=005778455

Since ARIMA (0,0,1) is selected as the best model for its lowest MSE value, we can further look at the model's forecasting plot to check whether it actually works or not. Figure 4, which is captured from STATLETS' Forecasting Plot Screen confirms that the forecasting model works properly. In Figure 4, small boxes represents the actual data, the plot within the little boxes indicates the forecasted values generated by the model to fit the data and the line between Q4/03 and Q4/04 indicates the projected forecast values for the next four quarters.

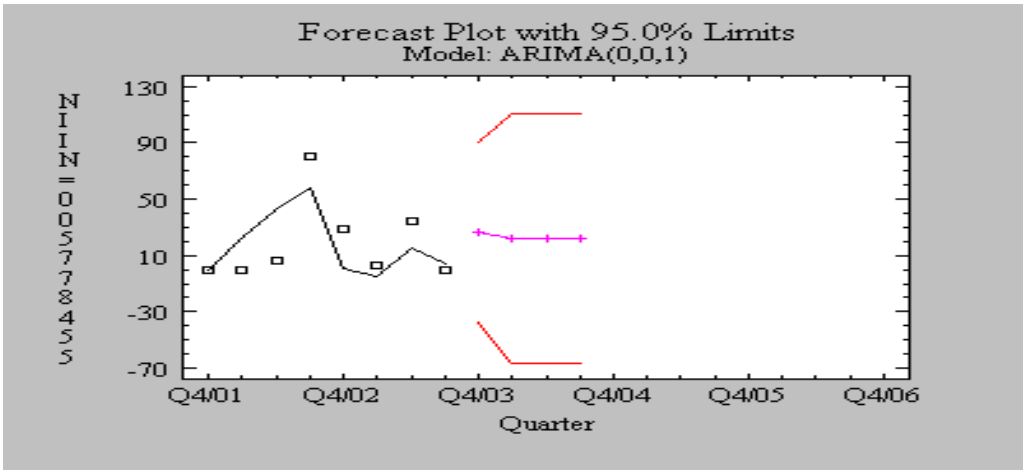


Figure 4. STATLETS' Forecasting Plot for NIIN=005778455

For further analysis, the program also provides the model summary, each period's forecasted values with the residuals and the forecasted values for the next period along with their lowest and highest values within a 95 % level of confidence. Such an output is shown in Figure 5.

Forecast Summary

Data variable: NIIN=005778455
Number of observations = 8
Start index = Q4/01
Sampling interval = 1.0 quarter(s)

Forecast model selected: ARIMA(0,0,1) with constant
Number of forecasts generated: 4
Number of periods withheld for validation: 0

Period	Forecast	Lower 95.0% Limit	Upper 95.0% Limit
Q4/03	26.6191	-37.6604	90.8986
Q1/04	22.3023	-66.3852	110.99
Q2/04	22.3023	-66.3852	110.99
Q3/04	22.3023	-66.3852	110.99

ARIMA Model Summary

Parameter	Estimate	Stnd. Error	t	P-value
MA(1)	0.950587	0.190078	5.00	0.0024
Mean	22.3023	2.91495	7.65	0.0003
Constant	22.3023			

Backforecasting: yes
Estimated white noise variance = 690.091
Degrees of freedom = 6
Estimated white noise standard deviation = 26.2696
Number of iterations: 18

Model Fitting
Data variable: NIIN=005778455
Forecast model selected: ARIMA(0,0,1) with constant

Period	Data	Forecast	Residual
Q4/01	0.0	-0.466595	0.466595
Q1/02	0.0	21.8588	-21.8588
Q2/02	6.0	43.0809	-37.0809
Q3/02	80.0	57.5509	22.4491
Q4/02	29.0	0.962506	28.0375
Q1/03	3.0	-4.34978	7.34978
Q2/03	34.0	15.3157	18.6843
Q3/03	0.0	4.54123	-4.54123

Figure 5. STATLETS' Forecast and Model Summary Output for NIIN=005778455

We applied the same procedure for all the items and recorded the best model and its associated MSE value in order to compare them to the current model's MSE values. After applying our proposed methodology, we found that our proposed model's MSE values for almost all the items in our sample data were less than the current model's MSE values. Appendix-B includes the MSE values of both the proposed model and the current model for the 1,600 sample items. In order to make a simple comparison of the two models, we calculated the improvement ratio of MSE for 1,600 items in our sample data. Figure 6 illustrates the histogram of improvement ratio. This ratio is simply calculated by dividing the current model's MSE values to the proposed model's MSE values.

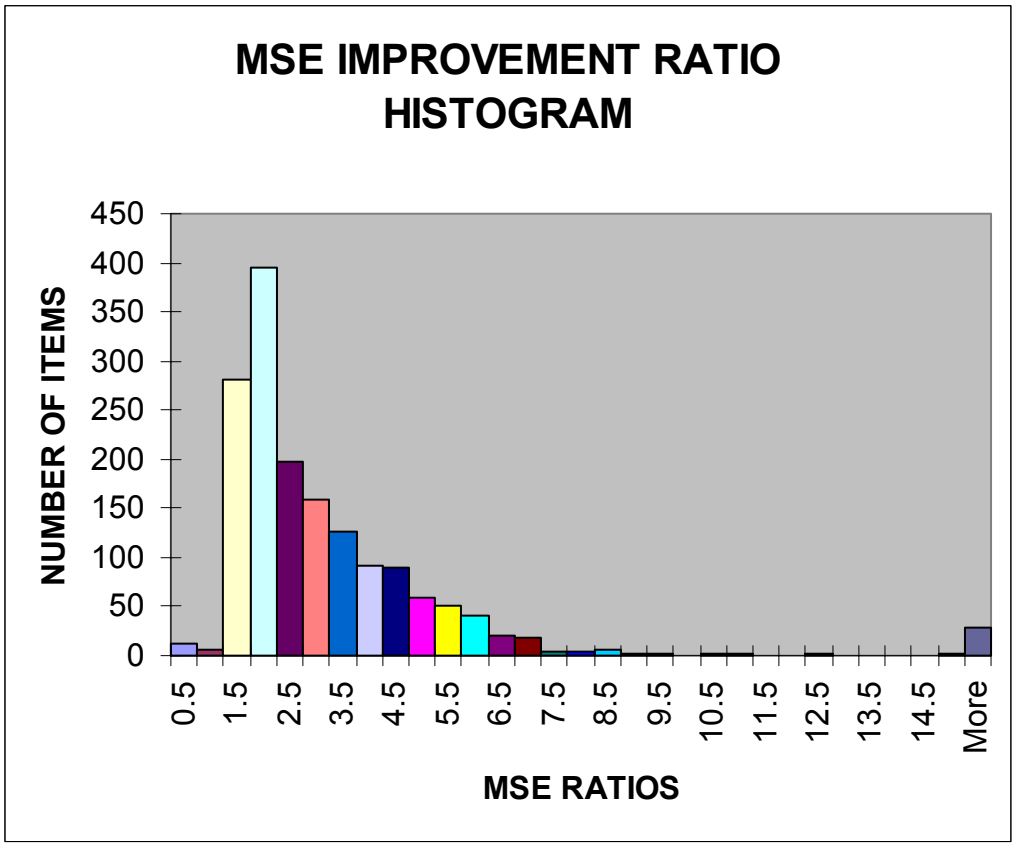


Figure 6. Improvement Ratio of MSE

In Figure 6, MSE Ratios that are greater than one represents the cases in which our proposed methodology performs more accurately. As Figure 6 illustrates, our proposed methodology significantly reduced the MSE values of 1,594 items; hence the accuracy of the forecasts was increased in 99.6 % items.

V. FORECASTING INTERMITTENT DEMAND ITEMS AND DEALING WITH NON-DEMAND BASED ITEMS

A. INTRODUCTION

To this point, we have discussed forecasting the demands for the items whose demand frequency was reasonably high so that we could use stochastic forecasting models. The problem arises with the items that have infrequent demands, and this is generally the situation. Since we cannot use the previous models for items that have infrequent demand patterns or have just one quarter of observed demand, we need to find another methodology specifically designed to deal with them. A second problem is that some items may have unusual spikes in demand and this causes the forecasting models to overforecast, causing the stock levels and the inventory costs to increase unnecessarily.

In this chapter, we first explain why the Turkish Navy's current method is not suitable for forecasting intermittent demand items and briefly discuss Croston's forecast method [Ref 12] developed to forecast items with intermittent demand. Secondly, we explain the effects of unusual spikes in demand on forecasting and further explain how to lessen their undesirable effects on the result of forecasting. To achieve this, we give specific examples using the actual demand data, and show how to apply demand filters. Finally, we explain how to deal with items that have only one quarter of demand.

B. FORECASTING FOR ITEMS WITH INTERMITTENT DEMAND

Generally, the preferred method used for forecasting intermittent demand is single-exponential smoothing since it is simple to use compared to other sophisticated methods and because it requires only two pieces of data: the last forecast and the observation of the last period [Ref 11]. In 1972, Croston [Ref 12] developed a method for forecasting in intermittent demand situations. He showed this method to be superior to single-exponential smoothing. He also showed that his method is unbiased, whereas the single-exponential smoothing method is biased. He further explained that the single-exponential smoothing method is biased because as a sequence of periods with zero demands, single-exponential smoothing leads to a continuing decrease in the forecast demand, reaching a low value immediately prior to the next demand occurrence [Ref 13,

Ref 14]. The result will be the same if the Turkish Navy's current method, the eight-quarter WMA model, is used to forecast the items with infrequent demand since this model places the most weight on the most recent data. The consequence of using this estimation method on an irregular issue pattern is to generate a series of estimates that are highest just after an issue, and correspondingly lowest just before an issue. This is identical to the situation we must face with the single-exponential smoothing model. For a better understanding, we chose an item that was demanded in just two quarters, and then we forecasted the quarterly demands using the eight-quarter WMA model. Figure 7 illustrates the actual demand and the forecasted demand for that item. Notice that in the seventh quarter, just before the demand, the forecast is at its lowest value, 5.2.

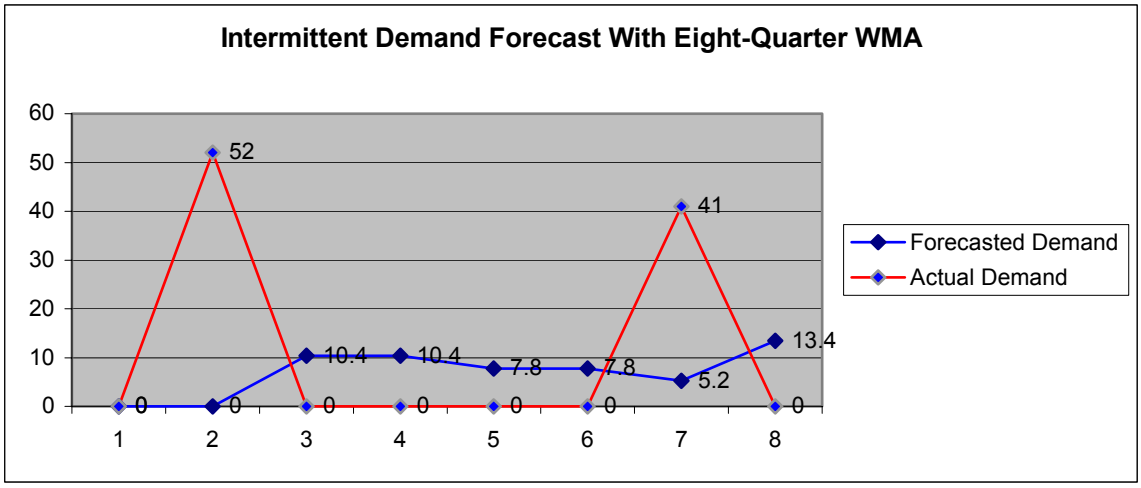


Figure 7. Eight-Quarter WMA Forecast for an Intermittent Demand Item

To give an unbiased estimate of the underlying demand, Croston suggested forecasting the two separate components of the demand process-namely, the average time between consecutive transactions and the average magnitude of individual transactions. However, we need at least 32 quarters of actual demand data to make a sound estimation for the time between consecutive demands and the magnitude of the individual demands. Because of that, Croston's method is not feasible for the Turkish Navy to implement.

Sani and Kingsman [Ref 13] compared five forecasting methods used with intermittent demand. These forecast methods include single-exponential smoothing (with

two different α's); a 12-month moving average method; Croston's forecasting method and a simple empirical forecasting method. Their research showed that, all in all, the simple-moving average method updated every review period indicated the general level of demand for items with intermittent demand more accurately. This was closely followed by the Croston's forecasting method. Although both Croston's forecasting method and the simple-moving average were much more appropriate methods than the traditional simple-exponential smoothing, Sani and Kingsman preferred the moving average because of its simplicity. They further concluded that with infrequent demand, a simple average over a reasonable period of time gave a better indication of the general level of demand, rather than exponentially decaying weights in time. Based on Sani and Kingsman's findings in [Ref 13] we suggest the Turkish Navy use a four-quarter moving average method for items with intermittent demands. A validation of this recommendation requires more data than we had in our database.

C. DEMAND FILTERS

Since our forecasting methodology is based on predicting future demand by extrapolating the past demand, we obviously want the history of demand to be as accurate as possible. Sometimes, one observation is widely different from all other observations. The problem is whether to keep the suspect observation in computing the forecasts or whether to discard the suspect observation as being a faulty measurement or an occurrence from an unusual circumstance that is not likely to repeat. If we use the faulty observation in the computations, this may distort the forecasts. A process called *filtering* is used to adjust for such a faulty measurement. A filtering process computes the normal dispersion of the data and uses this dispersion to identify the data that lie outside the norm. When the observation is outside the norm, it is identified as "outlier." This outlier may be discarded completely or modified before use in computations. In ideal situations, the outlier entry is brought to the attention of the item manager when the number of items to be forecasted is small. The item manager decides whether or not to include the entry in generating the forecast. Unfortunately, if there is a large number of items, such personal attention is not possible [Ref 15].

One approach to filtering is to compute the standard deviation (SD) of the data and to use a multiple of it as a norm for identifying and reducing any outlier. To illustrate how this process works, we provide the example shown in Table 7.

Demand Pattern	Quarters								Comment
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Original, Unfiltered Series	20	3	18	35	0	555	178	0	Mean=101.125 SD=192.672 MSE=28508.4
Filtered Series 3 SD	20	3	18	35	0	555	178	0	No change since all values are between 0 and 679.217 MSE= 28508.4
Filtered Series 2 SD	20	3	18	35	0	486	178	0	Quarter 6 reduced to mean plus 2 SDs MSE= 21879.7
Filtered Series 1 SD	20	3	18	35	0	294	178	0	Quarter 6 reduced to mean plus 1 SDs MSE=8580.31

Table 7. Filtering Demand for NIIN=010355294

The cost implications of an error would be high for a high-priced item and would be low for a low-priced item. Generally, a filtering factor of a lower standard deviation for high-priced items and a higher standard deviation for low-priced items is used. For example, one may choose to use a filtering factor of one standard deviation for high-priced items and two standard deviations for low-priced items.

Even though the filtering process generally reduces the forecast error, it must be used with care so that it does not hide real changes in demand patterns. In order to do that, we should apply filters only as temporary changes to the historical demand data for

purposes of forecasting with a stochastic model and should not change the real demand pattern of an item.

D. DEALING WITH NON-DEMAND BASED ITEMS

We designate items with fewer than two quarters of demand within an eight-quarter period as *non-demand based* items. For simplicity, we also divide n*on-demand based* items into two categories: "insurance items" and "Numeric Stockage Objective (NSO) items." An insurance item is an essential item for which no failure is predicted through normal usage, but if a failure is experienced, the lack of a replacement would seriously hamper the operational capability of a weapon system. On the other hand an NSO item is an essential item for which the probability of demand is so low that it does not meet the demand-based stockage criteria [Ref 7]. In our research NSO items are the items other than insurance items, for which the observed demand is greater than zero in only one quarter within a period of eight quarters.

For *non-demand based* items we do not suggest forecasting an individual-item demand and using a demand-based inventory model. Instead, for insurance items we suggest using a stockage criteria normally justified on the basis of how critical the items are to mission readiness, and for NSO items we suggest applying a simple numeric level, which is observed demand over an extended period of time (e.g., two years).

The U.S. Navy uses Item Mission Essentiality Code (IMEC) to establish the stock levels for insurance items. *Non-demand based* IMEC 3 and 4 are considered insurance items and stocked in quantities sufficient to support one maintenance action or one Minimum Replacement Unit (MRU). Since the Turkish Navy maintains the IMEC codes within its WMS database, we suggest that the Turkish Navy use IMECs to establish stock levels for insurance items as the U.S Navy does.

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

For effective decision making in inventory management, one needs predictions of the demands in future periods. We need forecasts to establish performance standards for customer service, to plan the allocation of total inventory investment, and to place replenishment orders. There are a number of forecasting methods, but none of them is best in all situations. Our analysis showed that, using only one forecasting model-namely, an eight-quarter weighted moving average model with different weight assigned to each quarter demand is not the most effective. However, using *"focus forecasting"* for items that have at least three quarters of demand within a period of eight quarters improves forecasting performance. This methodology allows us to use a software program and automates the forecasting process, and it requires only a one-time investment to buy the software and to train the users. Hence, we can conclude that it is feasible and cost-effective to implement.

Special classes of individual items, specifically, intermittent demand items and *non-demand based* items, must be handled with different methods. In the literature, both Croston's forecasting method and a simple moving-average method are suggested for forecasting with intermittent demand items. However, Croston's method is based on estimating the two separate components of the demand process, and this method requires a reasonable amount of observation to soundly estimate these two components. Because of this, Croston's method does not look feasible for the Turkish Navy to implement.

At the ICCC, no forecasting is performed for leadtimes. Safety stocks are directly related with inventory holding costs and service level, and demand-based inventory models use leadtimes to determine how much safety stock must be carried. For example, if PCLT is shorter than the old forecast, we would be ordering too soon and thus increasing our holding cost. And if the new PCLT is longer than the old forecast, then we would pass the time when we should have placed the order and the probability of a stock-out has now increased. Since every item has a different PCLT and PLT, for greater accuracy, forecasting the leadtimes of every item individually would be better. This is

feasible and cost-effective to implement for three reasons. First, establishing new data fields for PCLT and PLT within the WMS database is easy, and it does not require an additional investment. Second, PCLT and PLT data are obtainable during the procurement and delivery processes. Third, maintaining the PCLT and PLT data is not costly, since the storage capacity of the computers has increased tremendously.

Filtering the unusual spikes in demand has proven to be an effective technique in reducing errors. Unusual spikes in demand cause forecasting models to overforecast and results in inflated or false inventory levels. We need to use filters in order to improve the forecasting process by eliminating the undesirable effect of unusual spikes in demand. The filtering process is also feasible and cost-effective to implement because this process automatically computes the standard deviation of demand and makes temporary adjustments to the demand pattern. Since there is no human intervention, no skilled personnel are required. Additionally, establishing and maintaining a new data field required for the filtering process within the WMS database is not costly.

B. RECOMMENDATIONS

Based on our analysis and the findings in the literature, we make the following recommendations to the Turkish Navy

1. Forecasting Demand

- Use *focus forecasting* methodology for items with at least three quarters of demand within a period of eight quarters,
- Use the four-quarter moving average method for items with intermittent demand,
- For *non-demand based* items
  - Use the U.S. Navy's stockage criteria of one MRU for insurance items
  - Use a simple numeric level, which is observed demand over an extended period of time for NSO items.

2. Forecasting Procurement and Production Leadtimes

- Use the U.S. Navy procedures, introduced in Chapter III.

3. Data Requirements

- Store PCLT and PLTs, establish new data fields within the WMS database,

- For PCLTs, record the beginning date when an item manager initiates a procurement and record the ending date when the material is delivered to the stock point,
- For PLT, record the date when the contract is issued by the contracting department and record the date when the item is delivered to the stock point.

4. Using Demand Filters

- Use a conservative forecasting method for high-priced items and a less conservative forecasting method for low-priced items,
- Apply filters only as temporary changes to the historical demand data for purposes of forecasting and keep the real demand pattern of an item as it is.

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LIST OF REFERENCES

1. Joe K. Shim, *Strategic Business Forecasting*, pp. 29-30, St. Lucie Press, New York, 2000

2. Sypros Makridakis and Steven C. Wheelright, *Forecasting Methods and Applications*, p. 329, John Wiley & Sons, New York, 1978

3. George L. Slyman and Dennis L. Zimmerman, *Improved Inventory Models*, pp. B-12, B-13, 3-14, 2-1, Logistics Management Institute, 1993

4. Towey C. Bachman and Karl Kruse, *Forecasting Demand for Weapon System Items*, p. 1-4, Logistics Management Institute, 1994

5. Sypros Makridakis and Steven C. Wheelright, *The Handbook of Forecasting: A Manager's Guide*, Second Edition, pp. 509-511, John Wiley & Sons, New York, 1987

6. Telephone Interview with Ltjg. Ozlem Ozkok, U.S. Originated Item Manager, Inventory Control Center Command, Golcuk, Turkey, on August 10, 2001

7. Naval Supply System Command Publication, NAVSUP P-553, *Inventory Management: A Basic Guide to Requirements Determination in the Navy*, pp. 3-8, 3-11, 1978

8. Kevin R. Gue, *Handouts on Inventory Management*, Volume I, pp. 29-39, Chapter 2 36-37, Naval Postgraduate School, Academic Year 2001

9. Bernard T. Smith, *Focus Forecasting: Computer Techniques for Inventory Control*, CBI Publishing Company, Inc., Boston, 1978

10. Nada R. Sanders, *Measuring Forecast Accuracy: Some Practical Suggestions*, Production and Inventory Management Journal, pp. 43-46,Vol. 38, Iss:1, 1997

11. Barbara A. Price and H.C. Haynsworth, *How to Prepare Inventory Forecast for Very Low Demand Items*, p. 21, The Journal of Business Forecasting, Vol. 5, Iss:2, 1986

12. J.D. Croston, *Forecasting and Stock Control for Intermittent Demands*, pp. 289-303, Operational Research Quarterly, Vol. 23, 1972

13. B. Sani and B. G. Kingsman, *Selecting the Best Periodic Control for Intermittent Demands*, pp 700-713, Journal of the Operational Research Society, Vol. 48, No. 7, 1997

14. F. R. Johnston and J. E. Boylan, *Forecasting for Items with Intermittent Demand*, pp. 113-121, Journal of the Operational Research Society, Vol. 47, No. 1, 1996

15. Nick T. Thomopoulos, *Applied Forecasting Methods*, pp. 39-50, Prentice-Hall, Inc., New Jersey, 1980

BIBLIOGRAPHY

1. Sypros Makridakis and Steven C. Wheelright, *Forecasting Methods for Management*, Fourth Edition, John Wiley & Sons Inc., New York, 1985

2. Sypros Makridakis and Steven C. Wheelright, *Interactive Forecasting*, John Wiley & Sons Inc., New York, 1978

3. Mark L. Berenson and David M. Levine, *Basic Business Statistics: Concepts and Applications*, Second Edition, Prentice-Hall International Inc., London, 1983

4. C. D. J. Waters, *Inventory Control and Management*, John Wiley & Sons, New York, 1992

5. Paul Newbold, *Statistics for Business & Economy*, Fourth Edition, Prentice-Hall, New Jersey, 1995

6. Paul Bernard, *Integrated Inventory Management*, John Wiley & Sons Inc., New York, 1999

7. Tery Sincich, *Business Statistics by Example*, Dellen Publishing Company, Santa Clara, 1982

8. Cliff T. Ragsdale, *Spreadsheet Modeling and Decision Analysis*, South-Western College Publishing, Cincinnati, 2001

9. David M. Levine, Mark L. Berenson and David Stephan, *Statistics for Managers Using Microsoft® Excel*, Second Edition, Prentice-Hall, New Jersey, 1999

10. Borry Render and Ralph M. Stair, *Quantitative Analysis for Management*, Second Edition, Prentice-Hall, New Jersey, 2000

11. J. Holton Wilson and Barry Keating, *Business Forecasting*, Richard D. Irwin Inc., New Jersey, 1990

12. Thomas M. O'Donovan, *Short Term Forecasting: An Introduction to the Box-Jenkins Approach*, John Wiley & Sons, New York, 1983

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APPENDIX A. DATA FORMAT PROGRAM

```
//////////////////////////////////////////////////////////////////
//Author : Ozan APAYDIN
//Date :04 SEP 2001
//////////////////////////////////////////////////////////////////
//included header files
#include <iostream.h>
#include <fstream.h>
#include <stdlib.h>
#include "List.h"
#include "Stok.h"
//prototypes
void putToList(List&, char[], int, char[]);
void writeToFile (List& stokList);
//main function
int main() {
        //degiskenler
        char fileName[15];
        char stokNo[10];
        int adet;
        char tarih[9];
        bool isOpen = true;
        List stokList;
        cout << "Enter file name : ";
        cin >> fileName;
        cout << endl;
        //opening file
        ifstream infile(fileName);
        if(!infile) {
                cout << "Could not open " << fileName << endl;
                return 0;
```

```
	}
	//reading from file
	cout << "Reading..." << endl;
	int i = 1;
	while(infile >> stokNo >> adet >> tarih) {
		cout << "Line " << i <<endl;
		cout << stokNo << "    " << adet << "    " << tarih << endl;
		putToList(stokList,stokNo,adet,tarih);
		i++;
	}
	infile.close();
	//writing to the file
	writeToFile(stokList);
	return 0;
}
void putToList(List& stokList, char stokNo[], int adet, char tarih[]) {
	int Quarter;
	int Ay, Yil;
	char chay[3],chyil[3];
	bool first = true;
	bool second = false;
	bool third = false;
	int j = 0;
	for(int i = 0; tarih[i]; i++) {
		if(first) {
			if(tarih[i] == '/') {
				second = true;
				first = false;
				continue;
			}

			chay[i] = tarih[i];
		}
```

```
        if(second) {
                if(tarih[i] == '/') {
                        third = true;
                        second = false;
                        continue;
                }
                continue;
        }
        if(third) {
                chyil[j] = tarih[i];
                j++;
        }
}
//converting to int
Ay = atoi(chay);
Yil = atoi(chyil);
if(Ay >= 1 && Ay <= 3) {
        Quarter = 1;
}
if(Ay >= 4 && Ay <= 6) {
        Quarter = 2;
}
if(Ay >= 7 && Ay <= 9) {
        Quarter = 3;
}
if(Ay >= 10 && Ay <= 12) {
        Quarter = 4;
}
if(Yil == 00) {
        Yil = 100;
}
if(Yil == 01) {
        Yil = 101;
```

```
        }
        Quarter = Quarter + (Yil % 97) * 4;
//      cout << Quarter;
        Stok theStok = Stok();
        strcpy(theStok.stokNo, stokNo);
        ++theStok.f[Quarter - 1];
        theStok.q[Quarter-1] += adet;
        //putting list
        stokList.putList(theStok);
//      cout << "freq " << theStok.f[17];
}
void writeToFile (List& stokList) {
        char outputFile[20];
        Stok outStok;
        int numOutLine = 1;
        //Asking output file name
        cout << "Enter output file name : ";
        cin >> outputFile;
        //Beginning writing to output file
        cout << "Writing to the " << outputFile << endl;
        ofstream outfile(outputFile);
        while (!stokList.isListEmpty()) {
                stokList.deleteFromFront(outStok);
                outfile << outStok.stokNo << "   ";
                for(int i = 0; i < 20; i++) {
                        outfile << outStok.q[i] << "   " << outStok.f[i] << "   ";
                }
                outfile << endl;
                cout << "Line " << numOutLine++ << "completed" << endl;
        }

        outfile.close();
}
```

```
//List class
#ifndef __LIST_H
#define __LIST_H
#include "Stok.h"
#include <stddef.h>
#include <string.h>
#include <stdlib.h>
typedef Stok ListItemType;
typedef struct ListNode* PtrType;
struct ListNode {
        ListItemType Item;
        PtrType Next;
};
class List {
        public:
                List();
                ~List();
                bool isListEmpty();
                void addToFront(ListItemType);
                void addToBack(ListItemType);
                bool deleteFromFront(ListItemType&);
                int getListLength();
                PtrType getBackPtr();
                bool getListFront(ListItemType&);
                void putList(ListItemType);
        private:
                PtrType BackPtr;
};
#endif
//end of file List.h
//Stok class
#ifndef __STOK_H
#define __STOK_H
```

```
class Stok {
        public:
                int q[20];
                int f[20];
                char stokNo[10];
                Stok() {
                        for (int i = 0; i < 20; i++) {
                                q[i] = 0;
                                f[i] = 0;
                        }

                }

};
#endif
//end of file Caption.h
```

APPENDIX B. DATA RESULTS FROM ANALYSIS

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002871912	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	10651.40	24600.77	2.310
001794446	ELECTRON TUBE	4-QTR SIMPLE MA	102.08	687.13	6.731
008664143	LAMP,INCANDE. 4.7V 2.35W PAR36	LINEAR TREND	14602.50	23231.94	1.591
002156355	FIXTURE,LIGHTING	ARIMA(0,0,1)	48.91	83.05	1.698
001978491	PACKING MATERIAL	ARIMA(0,0,1)	812.27	1465.78	1.805
009312473	FILTER ELEMENT,FLUID	ARIMA(0,1,1)	593.34	1080.09	1.820
003635770	CARTRIDGE,WATER DEMINERALIZER,	ARIMA(0,0,1)	24.09	43.58	1.809
009733909	FILTER ELEMENT,FLUID	ARIMA(0,1,1)	617.95	1466.20	2.373
001895973	ELECTRON TUBE	ARIMA(0,0,1)	137.72	653.52	4.745
002620210	ELECTRON TUBE	LINEAR TREND	61.64	177.40	2.878
005999548	PACKING MATERIAL	LINEAR TREND	4038.26	5970.16	1.478
001717841	SPACER,RING	ARIMA(0,0,1)	286.55	484.69	1.691
006154309	SEMICONDUCTOR DEVICE,DIODE	LINEAR TREND	160.64	281.41	1.752
012401078	PISTON,COMPRESSOR	ARIMA(0,0,1)	4.15	10.75	2.588
002880695	RING SET,PISTON	ARIMA(0,0,1)	330.62	780.70	2.361
002433787	FUSE,CARTRIDGE	ARIMA(0,1,1)	18.90	92.90	4.914
010404492	SEAL SHAFT	LINEAR TREND	144.45	202.86	1.404
004724653	VALVE PLATE,COMPRESSOR	ARIMA(0,0,1)	267.66	815.93	3.048
005806283	FILTER ELEMENT,FLUID	LINEAR TREND	430.85	848.41	1.969
002708473	PAPER,GASKET	LINEAR TREND	553.82	1019.28	1.840
011276911	DRIVE FORK,PUMP	ARIMA(0,0,1)	22.48	112.75	5.015
001737243	SCALE PREVENTIVE COMPOUND	ARIMA(0,0,1)	2973.66	7956.40	2.676
007637744	LAMP,INCANDESCENT	ARIMA(0,0,1)	85917.00	298021.43	3.469
000894130	FUSEHOLDER	ARIMA(0,0,1)	4.71	8.65	1.836
005999544	PACKING MATERIAL	EXPONENTIAL TREND	195.31	344.45	1.764
009381135	DIODE,SILICON	ARIMA(0,0,1)	51.06	100.70	1.972
009264324	SYNCHRO,RECEIVER-TRANSMITTER	ARIMA(0,0,1)	1.50	4.50	2.999
000914168	RETAINER,PACKING	ARIMA(1,0,0)	724.61	1220.44	1.684
000290388	FILTER ELEMENT,FLUID	LINEAR TREND	27.27	42.52	1.559
010229970	CARTRIDGE,CHEMICAL FEEDER,WATE	ARIMA(0,0,1)	3172.63	4159.31	1.311
005999546	PACKING MATERIAL	4-QTR SIMPLE MA	2982.95	9118.24	3.057
007643335	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	8.63	364.84	42.253
010234270	VALVE,DISCHARGE,COMPRESSOR	ARIMA(0,0,1)	110.46	138.67	1.255
010240288	VALVE,INLET	LINEAR TREND	14.00	17.69	1.264
011276949	RING SET,PISTON	LINEAR TREND	101.98	137.87	1.352
012064137	SEMICONDUCTOR DEVICE SET	ARIMA(0,0,1)	112.43	437.38	3.890
000839092	LAMP,INCANDESCENT	ARIMA(0,0,1)	409.81	1842.18	4.495
002804431	FUSE,CARTRIDGE	ARIMA(0,0,1)	1064.26	4640.39	4.360
005859501	ASBESTOS SHEET,COMP	ARIMA(0,0,1)	5.02	21.71	4.324
010452642	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,1,1)	53.55	196.85	3.676
009864068	PARTS KIT,ENGINE WATER PUMP	LINEAR TREND	21.14	43.16	2.041

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
012472220	CYLINDER SLEEVE	LINEAR TREND	864.07	1556.43	1.801
003934905	CYLINDER SLEEVE	LINEAR TREND	45.68	66.45	1.455
009803435	PACKING KIT	ARIMA(0,0,1)	19.16	29.49	1.539
013387780	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	22.23	151.27	6.804
002707111	NUT,PLAIN,HEXAGON	ARIMA(0,1,1)	13043.00	46906.00	3.596
007052849	VANE,PUMP,ROTARY	ARIMA(0,0,1)	22.02	158.10	7.180
006289276	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,0,1)	29.81	92.99	3.119
001558707	LAMP,INCANDESCENT	LINEAR TREND	939.25	1370.20	1.459
013833870	GASKET	ARIMA(0,1,1)	399.35	1193.80	2.989
004289722	PARTS KIT,DIESEL ENGINE	LINEAR TREND	80.82	132.10	1.635
001608296	BELT,V	LINEAR TREND	383.19	490.12	1.279
003649793	GASKET	ARIMA(1,0,0)	3.80	7.29	1.920
010262935	FILTER ELEMENT,FLUID	4-QTR SIMPLE MA	1264.45	4309.90	3.409
011064332	SEAL,PLAIN ENCASED	ARIMA(0,0,1)	28.30	41.83	1.478
011471413	FILTER ELEMENT,FLUID	HOLT'S LINEAR	2.20	2.55	1.161
013021848	FILTER ELEMENT,FLUID	LINEAR TREND	3649.74	8176.07	2.240
009453146	REED STRIP,VALVE	ARIMA(0,1,1)	953.76	2759.35	2.893
001557857	LAMP,INCANDESCENT	ARIMA(0,1,1)	411.80	1062.90	2.581
013387820	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	63947.10	157445.29	2.462
009674820	RING,PISTON	ARIMA(0,0,1)	416.99	590.01	1.415
009532460	GUIDE,VALVE STEM	ARIMA(0,0,1)	10974.80	33597.24	3.061
000202733	TUBE ASSEMBLY,METAL	ARIMA(0,0,1)	2632.99	8630.41	3.278
012581154	IMPELLER,PUMP,CENTRIFUGAL	4-QTR SIMPLE MA	17.73	93.68	5.283
006660964	RELAY,THERMAL	ARIMA(0,0,1)	21.36	26.49	1.240
003538174	GASKET	ARIMA(0,1,1)	224.39	724.44	3.229
011979826	PARTS KIT, AIR COMPRESSOR ASSE	ARIMA(0,1,1)	2.72	5.54	2.037
008807616	SILICONE COMPOUND	LINEAR TREND	3519.39	4637.58	1.318
001100196	RESISTOR,FIXED,COMPOSITION	4-QTR SIMPLE MA	5.59	10.55	1.886
011144422	TRANSMITTER	LINEAR TREND	0.24	0.91	3.720
004622248	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,0,1)	10.51	45.01	4.284
009222422	PARTS KIT,ENGINE WATER PUMP	ARIMA(0,0,1)	30.07	169.09	5.623
010355294	LAMP,INCANDESCENT	LINEAR TREND	28508.40	39840.46	1.397
001817597	CLEANING COMPOUND-55 GL	LINEAR TREND	18178.60	23821.99	1.310
001433060	LAMP,INCANDESCENT	ARIMA(0,0,1)	27.53	97.59	3.545
005806304	FILTER ELEMENT,FLUID	LINEAR TREND	69.22	104.20	1.505
007995474	PARTS KIT,SIGHT INDICATOR	LINEAR TREND	124.99	571.52	4.573
013332224	FAN,VANEAXIAL	ARIMA(0,0,1)	83.87	238.52	2.844
001557836	LAMP,INCANDESCENT	ARIMA(0,0,1)	5095.43	12764.61	2.505
007760688	CARTRIDGE,OXYGEN RE	ARIMA(0,0,1)	3.73	7.98	2.138
009491432	TRANSISTOR	ARIMA(0,1,1)	3.48	12.03	3.452
009921009	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	21.19	33.71	1.591
009260237	TRANSISTOR	ARIMA(0,0,1)	8.26	27.93	3.380
010242512	O-RING	ARIMA(0,0,1)	118.95	336.74	2.831
006628992	BEARING HALF SET,SLEEVE	ARIMA(0,0,1)	1540.54	3033.99	1.969
004503894	PACKING MATERIAL	ARIMA(0,0,1)	1618.37	3771.77	2.331

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002483836	O-RING	ARIMA(0,0,1)	3.61	7.98	2.213
008074197	FENDER,MARINE	ARIMA(0,1,1)	346.37	1358.26	3.921
008663158	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	95.16	156.01	1.639
001080252	ELECTRON TUBE	ARIMA(0,0,1)	26.78	64.26	2.399
002845823	ELECTRON TUBE	ARIMA(0,0,1)	11.05	55.79	5.050
009576865	DIODE	ARIMA(0,0,1)	71.27	104.76	1.470
002804428	FUSE,CARTRIDGE	ARIMA(0,0,1)	3579.75	10008.14	2.796
009253777	TRANSISTOR	ARIMA(0,0,1)	8.43	36.82	4.367
001978493	PACKING MATERIAL	ARIMA(0,0,1)	138.69	368.67	2.658
005995780	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	5141.33	7980.46	1.552
008924420	LAMP,GLOW	LINEAR TREND	1030.10	1499.41	1.456
001978494	PACKING MATERIAL	4-QTR SIMPLE MA	217.53	574.75	2.642
009321353	BATHYTHERMOGRAPH,PR	ARIMA(0,0,1)	1139.51	2080.42	1.826
003775548	FILTER ELEMENT,FLUID	ARIMA(0,1,1)	11056.50	21249.67	1.922
009920695	SEAL,VALVE GUIDE	ARIMA(0,1,1)	13443.50	46504.60	3.459
005917657	GASKET	ARIMA(0,0,1)	6.03	9.11	1.512
001522993	LAMP,FLUORESCENT	LINEAR TREND	24229.90	40676.38	1.679
001716649	O-RING	ARIMA(0,0,1)	9.13	14.49	1.586
000014194	WATER INDICATING PA	ARIMA(0,0,1)	40.33	116.38	2.885
010673033	DIODE	LINEAR TREND	0.45	0.82	1.819
000572887	LAMP,INCANDESCENT	ARIMA(0,0,1)	207.46	440.34	2.123
000733010	PARTS KIT,FUEL INJECTOR,DIESEL	LINEAR TREND	154.17	293.65	1.905
000648554	CARTRIDGE,DEHYDRATOR	ARIMA(0,0,1)	268.21	383.61	1.430
012210600	TRANSISTOR	LINEAR TREND	0.55	1.98	3.600
005430219	ELECTRON TUBE	LINEAR TREND	10.60	24.18	2.281
006982936	PARTS KIT,FUEL INJECTOR,DIESEL	LINEAR TREND	1158.56	2036.12	1.757
001565046	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	68.33	245.26	3.589
001790052	RUBBER SHEET,SOLID,CLOTH INSER	LINEAR TREND	32.42	48.18	1.486
001982417	BEARING,BALL,ANNULAR	LINEAR TREND	18.97	34.00	1.793
009518757	TRANSISTOR	LINEAR TREND	32.51	49.20	1.513
002934208	WIRE,NONELECTRICAL	ARIMA(0,0,1)	193.84	540.90	2.790
000642379	SEMICONDUCTOR DEVICE,DIODE	CONSTANT MEAN	176.94	19.25	0.109
006046654	FILTER ELEMENT,FLUID	LINEAR TREND	32.42	65.49	2.020
006782838	SEAL ASSEMBLY,SHAFT,SPRING LOA	LINEAR TREND	18.97	95.02	5.010
009873736	BEARING,BALL,ANNULAR	LINEAR TREND	32.51	2.54	0.078
001979656	PACKING MATERIAL	ARIMA(0,0,1)	193.84	2420.55	12.487
000976345	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	33.50	97.06	2.897
001346073	ELECTRON TUBE	LINEAR TREND	45.64	83.67	1.833
001588255	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	7.99	33.34	4.174
014255576	FILTER ELEMENT,FLUID	ARIMA(0,1,1)	15.31	225.35	14.720
004014956	BATTERY,STORAGE	ARIMA(0,1,1)	37.97	76.43	2.013
003413682	VALVE ASSEMBLY	ARIMA(0,0,1)	2.10	4.56	2.168
006011322	TRANSDUCER,VIB.	ARIMA(0,0,1)	8.72	13.62	1.562
007750512	SEMICONDUCTOR DEVICE SET	CONSTANT MEAN	224.00	266.01	1.188
008009055	VALVE,SOLENOID	4-QTR SIMPLE MA	14.89	21.21	1.425

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
010614762	VALVE,CONTROL	ARIMA(0,0,1)	18.45	38.50	2.087
010658297	CYLINDER HEAD,DIESEL ENGINE	ARIMA(1,0,0)	53.47	72.29	1.352
011224114	PUMP,ROTARY	ARIMA(0,0,1)	2.36	3.89	1.645
011795538	VALVE,INLET	ARIMA(0,0,1)	7.60	12.96	1.704
012416805	ROTOR,PUMP	ARIMA(0,0,1)	3.36	5.46	1.626
011599482	CIRCUIT CARD ASSEMBLY	ARIMA(0,0,1)	0.07	0.32	4.284
011700702	LAMP,INCANDESCENT	ARIMA(0,0,1)	54.46	118.48	2.176
007096108	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,1,1)	13.60	34.98	2.572
008242139	SWITCH,THERMOSTATIC	ARIMA(1,0,0)	1.89	3.51	1.858
008669403	SEAL,WATERPUMP	ARIMA(1,0,0)	412.69	523.52	1.269
012218771	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(1,0,0)	86.78	121.76	1.403
013430889	PISTON,COMPRESSOR	ARIMA(1,0,0)	15.97	23.94	1.499
001548358	SEAL,PLAIN ENCASED	ARIMA(0,0,1)	14.92	40.19	2.694
003643737	FERRULE,CYLINDER	ARIMA(0,0,1)	5685.94	15820.02	2.782
008278782	ELECTRON TUBE	LINEAR TREND	199.32	294.40	1.477
004244067	GASKET SET	ARIMA(0,1,1)	2.04	5.54	2.718
006991544	VALVE,POPPET,ENGINE	LINEAR TREND	600.74	880.55	1.466
001995773	RING,SEAL	ARIMA(0,1,1)	106.96	264.44	2.472
003628745	GASKET	ARIMA(0,0,1)	73.88	150.26	2.034
000382922	PACKING MATERIAL	ARIMA(0,0,1)	14.68	46.10	3.141
001237822	GOVERNOR,VALVE	ARIMA(0,0,1)	2.84	5.63	1.981
005999545	PACKING MATERIAL	ARIMA(0,0,1)	17128.90	38630.25	2.255
013387832	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	1333.45	2240.39	1.680
005181793	FUSE,CARTRIDGE	ARIMA(0,0,1)	64.51	218.09	3.381
011243701	FILTER ELEMENT,FLUID	4-QTR SIMPLE MA	8.13	21.95	2.701
001419026	FILTER ELEMENT,FLUID	LINEAR TREND	67.95	102.78	1.513
010736545	ROTOR MODULE ASSEMB	ARIMA(0,1,1)	0.25	1.04	4.175
001588259	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	885.24	1417.43	1.601
002894640	HEATING ELEMENT,ELECTRICAL,NON	LINEAR TREND	164.70	228.49	1.387
010931468	GOVERNOR,MOTOR	LINEAR TREND	2.09	3.04	1.452
013055508	GASKET SET	ARIMA(0,0,1)	294.89	541.01	1.835
013968100	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	5739.69	15205.31	2.649
008165698	CYLINDER SLEEVE ENG	ARIMA(0,1,1)	26.99	148.84	5.515
004333564	BELT,V	ARIMA(0,1,1)	149.78	392.08	2.618
010050545	O-RING	ARIMA(1,0,0)	387.92	528.57	1.363
010249690	GASKET	ARIMA(0,0,1)	7.49	9.35	1.248
010532476	SWITCH,LIQUID LEVEL	ARIMA(0,1,1)	0.89	36.22	40.574
010887281	PACKING,PREFORMED	4-QTR SIMPLE MA	96.17	3.54	0.037
011273874	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	26.80	133.05	4.965
011573630	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	3.59	161.62	45.008
011602440	ELECTRON TUBE	ARIMA(0,0,1)	3.59	7.56	2.106
012037928	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,0,1)	84.88	162.09	1.910
007525701	SEMICONDUCTOR DEVIC	ARIMA(0,0,1)	53.21	901.10	16.933
008264786	GASKET ASSORTMENT	ARIMA(0,0,1)	62.14	108.44	1.745
009616216	BEARING HALF,SLEEVE	LINEAR TREND	1603.99	2258.17	1.408

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002272556	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	76.88	151.64	1.973
002704697	LAMP,INCANDESCENT	LINEAR TREND	12281.60	21001.03	1.710
000824139	ELECTRON TUBE	ARIMA(0,1,1)	42.08	422.87	10.050
001978492	PACKING MATERIAL	LINEAR TREND	908.95	1211.64	1.333
001558706	LAMP,INCANDESCENT	LINEAR TREND	631.89	852.64	1.349
001794749	ELECTRON TUBE	LINEAR TREND	20.66	48.16	2.331
008522248	SEMICONDUCTOR DEVIC	ARIMA(0,0,1)	12.93	50.13	3.879
000357535	STRIP 1ST & 2ND STAGE	ARIMA(0,1,1)	322.28	1546.40	4.798
002341863	PIN,COTTER	ARIMA(0,0,1)	3.32	18.05	5.433
007233378	LAMP,GLOW	SES	38.18	40.83	1.069
001312902	RING,PISTON	HOLT'S LINEAR	21.21	55.74	2.628
001346031	ELECTRON TUBE	ARIMA(0,0,1)	29.41	84.95	2.889
005545396	BEARING,BALL,ANNULAR	LINEAR TREND	10.09	16.35	1.620
000972479	PUMP CTFGL 80GPM 5PSI 2100RPM	4-QTR SIMPLE MA	1.22	8.83	7.248
002244828	STARTER,FLUORESCENT LAMP	LINEAR TREND	10687.70	20722.87	1.939
008392325	PIN,COTTER	4-QTR SIMPLE MA	1.05	5.25	5.014
013019993	CYLINDER SLEEVE	ARIMA(0,0,1)	298.29	1396.03	4.680
005999547	PACKING MATERIAL	ARIMA(0,0,1)	11075.10	21495.75	1.941
005797916	O-RING	ARIMA(0,0,1)	11.55	26.03	2.253
003950642	VALVE,POPPET,ENGINE	ARIMA(0,0,1)	475.98	2065.79	4.340
008238804	WASHER-FLT	ARIMA(0,0,1)	0.10	0.39	4.084
002804438	FUSE,CARTRIDGE	ARIMA(0,0,1)	3798.67	13208.12	3.477
002708470	PAPER,GASKET	ARIMA(0,0,1)	45.29	192.96	4.261
000944208	GASKET	LINEAR TREND	10.81	31.97	2.957
010261008	SHOE,PUMP	ARIMA(1,0,0)	117.58	176.36	1.500
012882586	O-RING	LINEAR TREND	138.27	293.78	2.125
002825906	SEAL,PLAIN ENCASED	ARIMA(0,1,1)	15.76	50.04	3.175
003538175	GASKET	ARIMA(0,0,1)	7752.15	13704.28	1.768
005571629	TERMINAL,LUG	ARIMA(0,0,1)	1039.27	2191.52	2.109
010788859	GASKET	ARIMA(0,1,1)	416.15	1063.05	2.554
002860089	O-RING	ARIMA(0,0,1)	4352.43	13401.26	3.079
002323279	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	132.77	309.03	2.328
001311255	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	1.57	3.20	2.039
001410717	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	2.83	4.39	1.551
001070656	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	1.01	5.62	5.572
002846787	FUSE,CARTRIDGE	ARIMA(0,0,1)	74.11	117.51	1.586
010931372	ACTUATOR,POWER LEVE	ARIMA(0,0,1)	2.93	16.38	5.595
000106652	FUSES	ARIMA(0,0,1)	0.40	2.09	5.261
010717360	DIODE	LINEAR TREND	24.36	39.40	1.617
010733786	DIODE	ARIMA(0,0,1)	5.02	29.37	5.848
002518839	O-RING	ARIMA(0,1,1)	12.97	27.37	2.110
001675173	O-RING	LINEAR TREND	146.02	244.97	1.678
000757477	PISTON,INTERNAL COMBUSTION ENG	ARIMA(0,0,1)	215.36	711.08	3.302
006047884	ADJUSTER,LASH	LINEAR TREND	1674.32	2360.92	1.410
005555207	BEARING,BALL,ANNULAR	LINEAR TREND	125.45	174.00	1.387
003345816	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	1.11	3.25	2.927

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
010494114	GASKET,SPIRAL WOUND	LINEAR TREND	389.43	1045.63	2.685
010294217	ION EXCHANGE COMPOUND	HOLT'S LINEAR	1312.08	976.17	0.744
002620161	ELECTRON TUBE	SES	12.26	14.50	1.182
008795078	ELECTRON TUBE	LINEAR TREND	10.56	26.76	2.535
009105287	VALVE,POPPET,ENGINE	ARIMA(0,0,1)	1.46	15.87	10.855
006473619	CYLINDER SLEEVE	ARIMA(0,0,1)	825.50	1493.06	1.809
008445873	RING SET,PISTON	LINEAR TREND	10.27	14.00	1.364
001660975	O-RING	ARIMA(1,0,0)	39.50	198.71	5.031
002894641	HEATING ELEMENT,ELECTRICAL,NON	ARIMA(1,0,0)	166.62	249.70	1.499
001979654	PACKING MATERIAL	LINEAR TREND	388.64	569.35	1.465
002777225	HOSE ASSEMBLY,AIR D	ARIMA(0,0,1)	274.58	2411.20	8.782
003538297	CYLINDER HEAD,DIESEL ENGINE	ARIMA(0,0,1)	7.93	12.84	1.619
005304034	O-RING	LINEAR TREND	3351.56	4967.71	1.482
005674398	FOLLOWER ASSEMBLY CAM	ARIMA(0,0,1)	413.80	1052.69	2.544
000069850	INDICATOR,TEMPERATURE,ELECTRIC	LINEAR TREND	3.36	4.52	1.345
002239100	LAMP,GLOW	ARIMA(0,0,1)	38.30	127.26	3.323
005005183	CONNECTOR,PLUG,ELECTRICAL	LINEAR TREND	6.48	9.71	1.498
009283127	CONNECTOR,PLUG,ELECTRICAL	LINEAR TREND	7.74	11.18	1.445
003794301	GASKET SET	ARIMA(0,0,1)	103.81	198.63	1.913
006919701	PISTON ASSEMBLY,DIESEL ENGINE	HOLT'S LINEAR	250.28	226.59	0.905
003638198	CORE ASSY,FLUID COOLER	ARIMA(0,0,1)	3.59	5.96	1.663
001793710	ELECTRON TUBE	ARIMA(0,0,1)	14.00	54.70	3.907
009920696	HEAD ASSEMBLY,CYLIN	ARIMA(0,0,1)	1.42	4.24	2.988
002273276	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	11.21	36.81	3.285
005660787	VANE SET,ROTARY	ARIMA(0,0,1)	99.45	532.55	5.355
000043443	PARTS KIT,FUEL INJECTION NOZZL	4-QTR SIMPLE MA	59.33	382.16	6.442
010639810	CAM,CONTROL	ARIMA(0,0,1)	21742.00	39752.32	1.828
010736114	CONTROL ASSEMBLY	ARIMA(0,0,1)	0.06	0.92	15.493
002186776	BEARING HALF,SLEEVE	ARIMA(0,1,1)	18.13	46.94	2.589
008929311	FUSEHOLDER,EXTRACTO	4-QTR SIMPLE MA	0.64	5.77	9.001
004255142	GASKET	ARIMA(0,1,1)	100.02	1752.09	17.517
012547168	VALVE,POPPET,ENGINE	LINEAR TREND	1976.19	2598.75	1.315
009199941	THERMOSTATIC POWER ASSEMBLY	ARIMA(0,0,1)	0.37	2.32	6.272
001793252	ELECTRON TUBE	ARIMA(0,0,1)	15.64	46.24	2.957
007648237	LAMP,INCANDESCENT	ARIMA(0,0,1)	3183.49	10948.01	3.439
010225632	GASKET	ARIMA(0,0,1)	13.73	23.11	1.683
009769010	FILTER ELEMENT,INTAKE AIR CLEA	ARIMA(0,1,1)	1.51	7.67	5.065
010299412	AMPLIFIER,DEFLECTIO	ARIMA(0,0,1)	0.59	1.21	2.066
006180475	WASHER,FLAT	ARIMA(0,0,1)	18.23	29.95	1.643
010136416	SWITCH,FLOW	ARIMA(0,0,1)	0.22	0.77	3.466
013882449	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	1799.01	5802.30	3.225
002919762	PACKING,PREFORMED	ARIMA(0,1,1)	4.32	13.10	3.032
000312813	GASKET	ARIMA(1,0,0)	821.44	1473.98	1.794
000840033	GASKET	ARIMA(0,0,1)	420.66	2295.83	5.458
013795982	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	40.14	125.84	3.135
005013681	BOLT,TEE HEAD	4-QTR SIMPLE MA	3.72	17.11	4.600

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002126290	GASKET	LINEAR TREND	9.18	14.11	1.537
006628425	BEARING,SLEEVE	ARIMA(0,0,1)	646.36	1060.01	1.640
008423044	PIN,COTTER	ARIMA(0,0,1)	182.46	427.20	2.341
002620828	CONTACT ASSEMBLY,ELECTRICAL	ARIMA(0,0,1)	181.05	568.19	3.138
009324792	GASKET	ARIMA(0,0,1)	25.41	61.26	2.411
009380434	TEMPERATURE INDICATING COMPOUN	ARIMA(0,0,1)	2.47	10.61	4.294
004200722	SEAL,PLAIN	LINEAR TREND	31.93	46.94	1.470
006823411	LAMP,GLOW	ARIMA(0,0,1)	65.16	290.45	4.457
008078993	O-RING	4-QTR SIMPLE MA	4.46	21.43	4.803
010591009	FILTER ELEMENT,FLUID	ARIMA(1,0,0)	11.80	29.96	2.539
001194475	ELECTRON TUBE	ARIMA(0,0,1)	48.17	87.77	1.822
002624701	SPACER,RING	ARIMA(0,0,1)	7.84	21.53	2.745
008850214	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	70.79	214.48	3.030
001433142	LAMP,INCANDESCENT	ARIMA(0,0,1)	5.63	31.22	5.549
001558634	LAMP,INCANDESCENT	ARIMA(0,0,1)	1055.47	2792.45	2.646
002462913	WASHER,FLAT	ARIMA(0,0,1)	182.44	342.62	1.878
004965575	SEMICONDUCTOR DEVICES,UNITIZED	ARIMA(0,0,1)	2.09	12.83	6.131
014554730	FILTER ELEMENT,FLUID	ARIMA(1,0,0)	1069.22	1513.39	1.415
014115415	FUSE,CARTRIDGE	LINEAR TREND	18.52	28.55	1.542
014115423	FUSE,CARTRIDGE	LINEAR TREND	20.14	31.16	1.547
000181217	SEMICONDUCTOR DEVIC	LINEAR TREND	5.42	10.99	2.027
001130352	COVER,ELECTRICAL CO	ARIMA(0,0,1)	0.31	1.40	4.587
002274423	BEARING,ROLLER,NEEDLE	ARIMA(0,0,1)	0.18	0.69	3.885
005197733	FUSE,CARTRIDGE	ARIMA(0,0,1)	4.62	22.31	4.829
007023435	SEMICONDUCTOR DEVICE,DIODE	LINEAR TREND	1.39	2.15	1.541
010408958	RELAY,ELECTROMAGNETIC	ARIMA(0,0,1)	0.31	1.40	4.587
000601125	INSERT,ENGINE VALVE SEAT	ARIMA(1,0,0)	1767.60	3207.93	1.815
008149196	GASKET	ARIMA(0,0,1)	292.04	636.42	2.179
001880926	ELECTRON TUBE	4-QTR SIMPLE MA	3.05	8.03	2.637
008429864	SEMICONDUCTOR DEVIC	ARIMA(0,0,1)	2.65	8.82	3.332
006137245	VALVE,BUTTERFLY	LINEAR TREND	3.98	6.39	1.606
002677024	FASTENER,BEAD CHAIN	LINEAR TREND	44.47	65.83	1.481
011953089	SWITCH,WAVEGUIDE	LINEAR TREND	0.76	1.31	1.727
002912958	WASHER,FLAT	ARIMA(0,0,1)	14.72	48.12	3.269
009381947	CORROSION PREVENTIVE COMPOUND	4-QTR SIMPLE MA	181.53	485.83	2.676
008082655	PUMP,FUEL,METERING AND DISTRIB	ARIMA(0,0,1)	5.20	13.51	2.600
009910942	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	12.25	28.85	2.354
002549287	JACK,TELEPHONE	ARIMA(0,1,1)	185.36	359.69	1.940
001135499	CAPACITOR,FIXED,CERAMIC DIELEC	LINEAR TREND	43.14	63.38	1.469
001209154	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	6.53	20.45	3.132
001219932	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	6.85	32.16	4.693
001240659	CAPACITOR,FIXED,CERAMIC DIELEC	ARIMA(0,0,1)	4.51	8.58	1.905
001410599	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.52	1.50	2.912
001790050	RUBBER SHEET,SOLID,CLOTH INSER	ARIMA(0,1,1)	1.13	7.30	6.478
001924758	PLUG,TELEPHONE	ARIMA(0,0,1)	3.49	15.53	4.443
002048990	TERMINAL,LUG	LINEAR TREND	1.22	2.03	1.673

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002433788	FUSE,CARTRIDGE	ARIMA(0,0,1)	10.88	18.68	1.717
002805031	FUSE,CARTRIDGE	ARIMA(0,0,1)	8.10	15.30	1.888
003456073	PUSH ROD,ENGINE POPPET VALVE	ARIMA(0,0,1)	437.02	763.49	1.747
003692434	GASKET	LINEAR TREND	0.39	0.80	2.033
004277448	LAMP,FLUORESCENT	LINEAR TREND	5240.47	6970.38	1.330
004746125	FUSE,CARTRIDGE	LINEAR TREND	23.82	38.08	1.599
004950042	CAPACITOR,FIXED,ELECTROLYTIC	ARIMA(0,0,1)	73.68	160.44	2.177
005858247	O-RING	LINEAR TREND	18.69	27.46	1.469
007275153	STRAP,TIEDOWN,ELECTRICAL COMPO	ARIMA(0,1,1)	0.82	2.27	2.756
008138265	LAMPHOLDER	ARIMA(0,0,1)	1.88	4.72	2.515
008779934	FUSE,CARTRIDGE	LINEAR TREND	56.11	83.97	1.496
009086292	CLAMP,HOSE	ARIMA(0,0,1)	1.78	4.54	2.547
010301770	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	4.79	27.49	5.742
010436935	CONNECTOR,PLUG,ELECTRICAL	ARIMA(0,0,1)	8.16	34.37	4.211
010976619	O-RING (NBR)	LINEAR TREND	29.47	43.89	1.489
005778455	LAMP,INCANDESCENT	ARIMA(0,0,1)	445.85	947.72	2.126
010374129	GASKET	LINEAR TREND	715.59	1010.39	1.412
000286741	PIN,PISTON	ARIMA(0,0,1)	941.73	2622.12	2.784
010053579	CONNECTOR,PLUG,ELECTRICAL	ARIMA(0,0,1)	308.84	523.71	1.696
010096741	GASKET	ARIMA(0,0,1)	807.04	1404.75	1.741
010614439	GASKET	ARIMA(0,0,1)	418.31	1404.66	3.358
000072004	CAPACITOR,TANTALUM	LINEAR TREND	2.27	3.32	1.463
000108666	CAPACITOR,FIXED,CERAMIC DIELEC	ARIMA(0,0,1)	3.28	7.16	2.183
001048332	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.53	0.93	1.745
001048350	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
001048358	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.83	1.77	2.134
001048368	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.64	2.68	1.634
001057764	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.22	2.07	1.702
001057767	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	2.47	3.71	1.506
001061278	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.38	0.89	2.306
001061356	RESISTOR,FIXED,COMPOSITION	ARIMA(1,0,0)	1.04	1.64	1.568
001069351	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
001107622	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.45	2.44	1.683
001114734	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
001114750	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.25	0.64	2.595
001134860	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.94	1.53	1.627
001134861	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
001140710	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	2.17	3.54	1.632
001145343	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.00	1.66	1.669
001157953	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.77	1.18	1.536
001168556	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	1.09	2.43	2.232
001193503	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.53	0.93	1.745
001193504	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.84	1.47	1.751
001193505	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.26	2.15	1.711
005013522	RIVET,SOLID	4-QTR SIMPLE MA	2.73	14.08	5.150
001198768	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	1.01	2.60	2.573

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
001198811	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	2.11	3.55	1.682
001266683	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	1.05	1.90	1.818
001353973	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.59	2.62	1.649
001363891	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.25	0.64	2.595
001410744	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.39	2.23	1.601
001411130	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
001411187	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
002014783	SOCKET,PLUG-IN ELECTRONIC COMP	ARIMA(0,0,1)	0.58	1.35	2.307
002590205	ADAPTER,CONNECTOR	CONSTANT MEAN	8.36	10.11	1.209
001259544	FILTER ELEMENT,FLUID	LINEAR TREND	1737.55	2296.78	1.322
002846804	FUSE,CARTRIDGE	LINEAR TREND	68.08	102.88	1.511
003378329	RETAINING DISK	LINEAR TREND	2.02	3.40	1.684
004356374	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.39	2.23	1.601
004673615	PAPER,GASKET	ARIMA(0,0,1)	88.85	138.82	1.562
004854545	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.41	0.84	2.084
005430789	KNOB	LINEAR TREND	3.77	5.40	1.433
011079531	FILTER ELEMENT,INTAKE AIR CLEA	ARIMA(1,0,0)	298.45	403.21	1.351
000545647	SCREW,MACHINE	LINEAR TREND	1.93	3.02	1.559
003371752	GASKET	LINEAR TREND	57.86	80.19	1.386
006171719	LAMP,INCANDESCENT	ARIMA(0,0,1)	369.49	919.01	2.487
008047566	CAPACITOR,FIXED,CERAMIC DIELEC	ARIMA(0,0,1)	0.41	0.84	2.084
008377262	TRANSISTOR	LINEAR TREND	1.26	2.15	1.711
008389421	CAPACITOR,FIXED,CERAMIC DIELEC	LINEAR TREND	1.14	1.91	1.676
009521549	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.25	0.64	2.595
010436897	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.25	0.64	2.595
010436900	CAPACITOR,FIXED,MICA DIELECTRI	LINEAR TREND	0.76	1.31	1.725
010445615	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.41	0.84	2.084
010454225	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.41	0.84	2.084
010675391	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.41	0.84	2.084
007807565	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	0.41	0.80	1.962
005516146	DISK,SOLID,PLAIN	ARIMA(1,0,0)	733.31	960.80	1.310
006006717	PLUNGER ASSEMBLY,INJECTOR	LINEAR TREND	28.86	80.41	2.786
006119909	GASKET	ARIMA(0,1,1)	0.20	0.90	4.413
001675110	O-RING	ARIMA(0,0,1)	202.77	399.20	1.969
009397859	LAMP, INCANDESCENT	CONSTANT MEAN	678.75	854.90	1.260
002099533	SPRING,HELICAL,COMPRESSION	LINEAR TREND	45.45	78.85	1.735
000200064	O-RING	4-QTR SIMPLE MA	13.14	54.22	4.126
000200067	O-RING	ARIMA(0,0,1)	16.57	56.77	3.425
005543232	BEARING,BALL,ANNULAR	LINEAR TREND	25.18	39.02	1.550
010584014	O-RING	ARIMA(0,0,1)	37.60	76.98	2.047
001063151	SPACER,RING	4-QTR SIMPLE MA	0.09	1.15	12.297
01F146083	COMPRESSOR	LINEAR TREND	6.82	10.55	1.547
005260640	GASKET	LINEAR TREND	285.80	444.99	1.557
009480035	PACKING,PREFORMED	ARIMA(1,0,0)	52.76	89.50	1.696
013674277	O-RING	ARIMA(0,0,1)	0.55	1.11	2.009
002385307	LINING,FRICTION	ARIMA(0,0,1)	10.01	17.14	1.712

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002232882	PACKING-PREFMD	ARIMA(0,0,1)	921.19	1477.83	1.604
001982856	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	17.20	45.21	2.629
006782836	GASKET SET	ARIMA(0,0,1)	16.11	27.22	1.690
008940684	SEMICONDUCTOR DEVICE DIODE	LINEAR TREND	2.44	3.80	1.555
000876047	SEMICONDUCTOR DEVIC	ARIMA(0,0,1)	1.37	2.46	1.787
001675166	O-RING	ARIMA(0,0,1)	287.70	1258.31	4.374
005930155	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	148.61	213.07	1.434
010189471	SCREEN,PUMP	ARIMA(0,0,1)	4.19	8.55	2.042
010655958	GASKET	ARIMA(0,0,1)	194.62	341.32	1.754
004079566	WASHER 1 LOCK	LINEAR TREND	1.32	2.13	1.614
002964093	STUFFING TUBE	ARIMA(0,0,1)	2023.00	11398.23	5.634
011134309	ELECTRON TUBE	ARIMA(0,1,1)	0.81	2.36	2.902
002803537	FUSE,CARTRIDGE	LINEAR TREND	738.95	981.85	1.329
001995749	GASKET	CONSTANT MEAN	644.98	807.16	1.251
002914691	GASKET	ARIMA(0,1,1)	28.79	128.53	4.464
002319922	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	22.27	67.29	3.021
010276863	MICROCIRCUIT	ARIMA(0,0,1)	0.94	3.29	3.501
006329979	ELECTRON TUBE	ARIMA(0,0,1)	1.78	3.86	2.166
002010778	SPRING,HELICAL,COMPRESSION	ARIMA(0,1,1)	3.08	14.15	4.600
000013481	PUMP,CENTRIFUGAL	ARIMA(0,1,1)	6.19	13.44	2.171
003370062	VANE,PUMP,ROTARY	LINEAR TREND	52.74	106.63	2.022
003668639	PARTS KIT,COMPRESSOR	ARIMA(0,0,1)	0.64	1.33	2.065
009056895	MICROPHONE,MAGNETIC	ARIMA(0,0,1)	2.07	3.51	1.694
010373297	ELECTRON TUBE	LINEAR TREND	5.11	7.97	1.559
010416784	SWITCH,OPTOELECTRONIC	ARIMA(0,0,1)	0.49	1.58	3.242
010781334	HEAD ASSEMBLY	ARIMA(0,0,1)	50.01	11.68	0.234
010960414	ELECTRON TUBE	ARIMA(1,0,0)	1.59	3.70	2.330
011015810	RECEPTACLE,PIN,WARM	LINEAR TREND	1.54	2.87	1.866
011069621	VALVE,SOLENOID	ARIMA(0,0,1)	108.94	166.16	1.525
011070541	RING,MATING	ARIMA(0,0,1)	16.01	54.57	3.409
011982915	VALVE,CHECK	LINEAR TREND	37.95	69.58	1.834
012186273	INSERT,TURBINE BLAD	ARIMA(0,0,1)	118.63	572.19	4.823
012429801	ELECTRON TUBE	LINEAR TREND	2.38	4.25	1.790
011594314	CIRCUIT CARD ASSEMB	ARIMA(0,0,1)	0.11	0.38	3.658
009170774	LAMP,INCANDESCENT	LINEAR TREND	250.84	331.73	1.322
009056894	MICROPHONE,MAGNETIC	LINEAR TREND	2.83	4.47	1.579
009048836	ELECTRON TUBE	LINEAR TREND	5.22	7.41	1.420
010655332	ELECTRON TUBE	ARIMA(0,1,1)	0.43	1.26	2.914
012095262	AMPLIFIER,GATED	LINEAR TREND	1.32	2.14	1.616
003027994	SEAL ASSEMBLY,SHAFT	ARIMA(0,0,1)	9.33	21.64	2.319
010230892	SEAL KIT	ARIMA(0,0,1)	2.06	6.96	3.381
010256150	PISTON AND ROD ASSE	ARIMA(0,1,1)	1.00	2.40	2.392
010328390	SEAL ASSEMBLY,SHAFT,SPRING LOA	LINEAR TREND	1.61	2.84	1.763
004296025	FILAMENT,COMBUSTIBLE GAS INDIC	ARIMA(0,0,1)	25.45	71.45	2.807
004943726	BULB,PRESSURE AND CIRCULATING,	4-QTR SIMPLE MA	2.73	14.08	5.150
010395358	PAD ASSEMBLY	ARIMA(0,0,1)	497.44	1124.81	2.261

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010898895	THERMOSTAT,FLOW CONTROL	ARIMA(0,0,1)	21.60	45.53	2.108
011956720	INJECTOR ASSEMBLY,FUEL	ARIMA(0,0,1)	1311.27	1878.47	1.433
012181012	SCREEN,PROTECTIVE	LINEAR TREND	34.59	51.39	1.486
013173511	PACKING ASSEMBLY	ARIMA(0,0,1)	1.26	4.10	3.254
002916028	GASKET	LINEAR TREND	1579.02	2160.97	1.369
002922054	O-RING	ARIMA(0,0,1)	1831.98	3160.69	1.725
003643307	SHAFT,SHOULDERED	ARIMA(0,0,1)	415.75	921.31	2.216
001433059	LAMP,INCANDESCENT	ARIMA(0,0,1)	5546.24	24158.20	4.356
005560145	KNOB	LINEAR TREND	0.54	0.88	1.631
005560151	KNOB	ARIMA(0,0,1)	0.33	1.24	3.781
001565041	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	1.15	25.11	21.854
003433367	VALVE,INJECTOR	LINEAR TREND	987.98	1353.16	1.370
003773497	THERMOSTAT,FLOW CONTROL	ARIMA(0,0,1)	41.07	89.99	2.191
001761558	PIN	SES	16.24	17.47	1.076
006254955	SEAL ASSEMBLY,SHAFT,SPRING LOA	LINEAR TREND	3.95	5.72	1.446
003538305	BONNET AND DISK ASSEMBLY	LINEAR TREND	105.58	161.28	1.528
005519786	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	13.86	58.50	4.219
010176535	O-RING	ARIMA(0,0,1)	999.42	4589.87	4.593
006818236	TAPE,INSULATION,ELECTRICAL	ARIMA(0,0,1)	3689.43	9873.28	2.676
004052226	BRUSH,ELECTRICAL CONTACT	ARIMA(0,1,1)	281.11	922.64	3.282
008181856	BEARING HALF SET,SLEEVE	ARIMA(0,0,1)	1011.32	2534.83	2.506
003934913	CRANKSHAFT,COMPRESSOR	LINEAR TREND	2.42	4.14	1.706
006254958	CONNECTING ROD,PISTON	ARIMA(0,0,1)	19.02	99.22	5.216
002938320	BEARING,ROLLER,NEEDLE	ARIMA(0,0,1)	0.21	0.92	4.299
000202734	TUBE ASSEMBLY,METAL	ARIMA(0,0,1)	91.68	374.14	4.081
005853282	BEARING,WASHER,THRUST	LINEAR TREND	76.39	114.25	1.496
010744923	VALVE ASSEMBLY	4-QTR SIMPLE MA	1.97	3.42	1.735
010890798	VALVE,REGULATING,FLUID PRESSUR	ARIMA(0,0,1)	0.95	2.64	2.788
011146905	TRANSFORMER,POWER	ARIMA(0,0,1)	0.40	2.29	5.785
011887002	CONTACT,ELECTRICAL	LINEAR TREND	59.89	86.91	1.451
000937350	RING,SEAL	ARIMA(0,0,1)	45.97	242.68	5.279
000944205	RING,SEAL	ARIMA(0,0,1)	19.80	65.32	3.300
010918483	GASKET	ARIMA(0,0,1)	22.66	44.09	1.945
005297992	PARTS KIT,ENGINE POPPET VALVE	ARIMA(0,0,1)	2118.68	4765.61	2.249
005328082	ROCKER ARM,ENGINE POPPET VALVE	ARIMA(0,0,1)	65.39	108.50	1.659
001651978	O-RING	ARIMA(0,0,1)	430.51	1105.55	2.568
001991611	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	16.57	34.81	2.100
002917337	O-RING	ARIMA(0,0,1)	0.16	0.92	5.782
003974483	GASKET	LINEAR TREND	185.81	260.04	1.399
005290344	BELT,V	ARIMA(0,0,1)	178.63	410.32	2.297
010097221	GASKET	ARIMA(0,0,1)	715.90	1568.31	2.191
010097224	GASKET	ARIMA(0,0,1)	1183.99	2025.31	1.711
010249700	GASKET	ARIMA(0,1,1)	30.58	73.23	2.394
010262856	SEAL ASSEMBLY,SHAFT	4-QTR SIMPLE MA	22.17	79.77	3.598
010283396	FILTER ELEMENT,FLUID	4-QTR SIMPLE MA	604.19	1003.22	1.660
010368534	PARTS KIT,SEAL REPLACEMENT,MEC	LINEAR TREND	1.39	2.59	1.861

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010376333	SEAL ASSEMBLY,SHAFT	ARIMA(0,0,1)	7.51	45.94	6.118
010578047	PACKING,RING	LINEAR TREND	22.20	30.56	1.377
010623770	FILTER ELEMENT,FLUID	LINEAR TREND	0.39	0.81	2.071
010947219	TRANSMITTER,PRESSURE	ARIMA(0,1,1)	1.53	3.08	2.012
010978150	PARTS KIT,SEAL REPLACEMENT,MEC	ARIMA(1,0,0)	147.07	248.70	1.691
011157845	PACKING	ARIMA(0,0,1)	54.89	104.03	1.895
011346899	STARTER,ENGINE,AIR	ARIMA(0,0,1)	1.01	2.98	2.938
012379099	RETAINER,BALL,BEARING	ARIMA(0,0,1)	10.54	45.87	4.351
004824194	BLADE,COMPRESSOR	4-QTR SIMPLE MA	109.27	439.93	4.026
010260657	GASKET,SPIRAL WOUND	4-QTR SIMPLE MA	2.98	26.06	8.733
002939302	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	13.78	32.78	2.378
001860965	WASHER,KEY	LINEAR TREND	9.78	13.02	1.331
001433049	LAMP,INCANDESCENT	ARIMA(0,0,1)	7.12	27.19	3.818
002704698	LAMP,INCANDESCENT	LINEAR TREND	34.97	54.62	1.562
010464623	CONNECTOR,PLUG,ELECTRICAL	ARIMA(0,0,1)	59.35	129.74	2.186
000343918	GAGE,VALVE INJECTOR	LINEAR TREND	1.53	2.35	1.533
000730472	CAP,FILLER OPENING	ARIMA(0,0,1)	12.40	39.35	3.172
000200186	PACKING,PREFORMED	ARIMA(0,0,1)	2.25	8.24	3.654
013815724	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	44.13	282.41	6.399
005743818	ELECTRON TUBE	ARIMA(0,0,1)	0.33	1.24	3.781
001448589	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	940.21	1443.79	1.536
002786736	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	27.67	80.28	2.902
005474938	SPRAY TIP,NOZZLE,FUEL INJECTOR	LINEAR TREND	119.11	176.03	1.478
004161129	AIR CLEANER ELEMENT	ARIMA(0,0,1)	59.13	164.53	2.782
000680508	SCREW,CAP,HEXAGON HEAD	LINEAR TREND	2.02	3.25	1.612
001888565	ELECTRON TUBE	ARIMA(1,0,0)	1.57	1.95	1.243
007854274	ELECTRON TUBE	ARIMA(0,0,1)	0.78	5.93	7.635
001996008	TRANSISTOR	LINEAR TREND	1.83	2.85	1.560
011968230	DIAPHRAGM,COMPRESSOR	ARIMA(0,0,1)	0.55	2.93	5.326
002773274	FILTER ELEMENT,FLUID	LINEAR TREND	302.25	457.79	1.515
009910943	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	3.90	9.88	2.537
000850468	TRANSISTOR	ARIMA(0,0,1)	8.00	13.51	1.689
002550296	SPACER,RING	ARIMA(0,0,1)	1116.75	6375.56	5.709
003643434	PACKING,PREFORMED	ARIMA(0,0,1)	0.65	2.16	3.322
006264361	RESTRICTOR,FUEL INJECTOR	ARIMA(0,0,1)	93.56	401.76	4.294
010430629	CONNECTOR,PLUG,ELECTRICAL	ARIMA(0,0,1)	39.86	122.82	3.081
000504208	LUBRICATION FITTING	ARIMA(0,1,1)	24.89	128.76	5.173
003538176	VALVE,POPPET,ENGINE	ARIMA(1,0,0)	1631.61	2284.35	1.400
002891891	LIFE PRESERVER,YOKE	ARIMA(0,0,1)	515107.00	1250795.87	2.428
000108715	CAPACITOR, CERAMIC	ARIMA(0,0,1)	0.86	1.42	1.647
000914470	SEAL	LINEAR TREND	4.55	7.71	1.695
000937358	RING,SEAL	LINEAR TREND	15.36	30.57	1.990
001789796	CORK SHEET	LINEAR TREND	202.33	273.30	1.351
002053443	GASKET	LINEAR TREND	14.48	23.45	1.619
003541227	SCREW,CAP,HEXAGON HEAD	ARIMA(0,0,1)	0.21	1.01	4.887
010318207	O-RING	ARIMA(0,0,1)	3844.99	7470.16	1.943

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012192046	SEMICONDUCTOR DEVICE,THYRISTOR	LINEAR TREND	0.06	0.28	4.625
012264271	FUSE,CARTRIDGE	ARIMA(0,0,1)	16.76	55.75	3.326
013034530	FILTER ELEMENT,FLUID	LINEAR TREND	208.23	304.01	1.460
001687818	ELECTRON TUBE	ARIMA(0,0,1)	0.56	1.73	3.111
001783773	SEAL,PLAIN ENCASED	ARIMA(0,0,1)	0.84	4.01	4.774
006013953	BEARING HALF,SLEEVE	ARIMA(1,0,0)	931.34	1209.72	1.299
005112336	WASHER HALF,THRUST	ARIMA(0,0,1)	90.13	500.69	5.555
005676264	RELAY,SWITCHSUBASSY	ARIMA(1,0,0)	16.45	22.13	1.345
003715367	GASKET AND SEAL SET	LINEAR TREND	31.77	48.07	1.513
006608054	CABLE,RADIO FREQUENCY	LINEAR TREND	1880.99	3318.77	1.764
005034880	ELECTRON TUBE	ARIMA(0,0,1)	2.68	4.47	1.667
003410544	MICROCIRCUIT,DIGITAL	LINEAR TREND	4.07	6.13	1.505
011166478	RING,PACKING	ARIMA(0,0,1)	0.35	1.45	4.097
001448518	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	0.62	3.79	6.072
001061357	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.91	1.576
001168555	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	6.32	20.91	3.307
001063667	RESISTOR,FIXED,COMP	ARIMA(0,0,1)	0.16	0.67	4.042
000454588	LAMP,CARTRIDGE	LINEAR TREND	35.68	51.38	1.440
009674819	RING,PISTON	ARIMA(0,0,1)	117.29	502.14	4.281
002559099	RING,PISTON	LINEAR TREND	254.74	366.60	1.439
005219820	EARPHONE ELEMENT	ARIMA(0,0,1)	876.68	1627.66	1.857
004752624	CARTRIDGE,DEHYDRATOR	ARIMA(0,0,1)	29.85	69.13	2.316
007528880	ROPE,FIBROUS	ARIMA(0,0,1)	24.34	63.58	2.612
002559101	RING,PISTON	LINEAR TREND	294.92	471.04	1.597
010299411	KLYSTRON DRIVE ASSE	ARIMA(0,1,1)	0.21	0.62	2.995
000603449	ELECTRON TUBE	ARIMA(0,0,1)	10.39	15.69	1.510
003628822	VALVE ASSEMBLY,INJECTOR	ARIMA(0,0,1)	404.84	1170.38	2.891
007025643	O-RING	ARIMA(0,1,1)	3.46	13.41	3.881
002708468	PAPER,GASKET	LINEAR TREND	7.83	12.52	1.600
012151140	VALVE,EXPANSION	4-QTR SIMPLE MA	4.64	16.22	3.496
000198087	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	23.40	54.99	2.350
003147473	IMPELLER,PUMP,CENTRIFUGAL	LINEAR TREND	66.77	119.60	1.791
006080489	SEAT,VALVE	ARIMA(0,0,1)	43.41	63.06	1.453
006254956	PISTON,COMPRESSOR	LINEAR TREND	93.30	149.01	1.597
002992884	STARTER,FLUORESCENT LAMP	ARIMA(1,0,0)	9861.18	37258.95	3.778
001850770	SEAL	ARIMA(0,1,1)	52.07	122.22	2.347
008052966	O-RING	ARIMA(0,0,1)	71.16	157.87	2.219
007090781	RING	LINEAR TREND	7.01	9.80	1.399
005992831	O-RING	LINEAR TREND	19.92	34.81	1.747
009789385	SCREW,CAP,SOCKET HEAD	LINEAR TREND	0.75	1.15	1.541
002519989	PIN,STRAIGHT,HEADLESS	ARIMA(0,0,1)	0.06	0.28	2.317
000600930	FUSE,CARTRIDGE	LINEAR TREND	16.76	55.75	1.390
008366504	ELECTRON TUBE	ARIMA(0,0,1)	208.23	304.01	3.085
008514352	LAMP, INCANDESCENT	ARIMA(0,0,1)	0.56	1.73	5.093
004037664	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	0.84	4.01	1.944
008395820	PIN,COTTER	LINEAR TREND	931.34	1209.72	1.541

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
003526952	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	4.13	10.13	2.455
009087291	VALVE,POPPET,ENGINE	ARIMA(0,0,1)	14.83	44.56	3.006
012477670	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	46.43	83.78	1.804
001312901	RING,PISTON	ARIMA(0,0,1)	11.49	41.98	3.654
007827826	RING-PSTN 2ND STG	ARIMA(0,1,1)	18.81	69.06	3.672
009526860	GASKET-HIP VL	ARIMA(0,0,1)	9.75	18.50	1.898
000504953	FUSE,CARTRIDGE	ARIMA(0,1,1)	12.94	177.50	13.722
001669841	SEAL ASSEMBLY,SHAFT	ARIMA(1,0,0)	60.30	88.80	1.472
002287882	FUSE,CARTRIDGE	CONSTANT MEAN	11.19	13.45	1.202
010677975	DEMISTER,EVAPORATOR	ARIMA(0,1,1)	7.48	18.37	2.456
008510366	FILTER,RADIO FREQUENCY INTERFE	ARIMA(0,0,1)	1.32	4.19	3.184
008835305	TRANSISTOR	ARIMA(0,0,1)	0.16	0.67	4.042
006296387	PARTS KIT,ENGINE FUEL PUMP	ARIMA(0,0,1)	9.80	19.64	2.004
002859842	O-RING	ARIMA(0,0,1)	3.51	18.46	5.261
003021960	SEAL,THERMOSTATIC	ARIMA(0,0,1)	23.42	44.60	1.904
007962600	BEARING HALF,SLEEVE	LINEAR TREND	84.93	117.14	1.379
014341473	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	81.09	290.63	3.584
009244165	SYNCHRO	LINEAR TREND	4.23	6.38	1.508
002483843	O-RING	LINEAR TREND	189.70	321.42	1.694
004345636	CRANKSHAFT,COMPRESSOR	ARIMA(0,0,1)	2.03	5.10	2.508
012012718	PARTS KIT,BUTTERFLY VALVE	ARIMA(0,0,1)	204.71	491.33	2.400
012862238	MICROCIRCUIT	ARIMA(0,0,1)	0.60	2.29	3.808
005319515	SCREW	LINEAR TREND	95.75	138.10	1.442
005769731	O-RING	LINEAR TREND	106.29	158.74	1.493
006115173	RING SET,PISTON	ARIMA(0,0,1)	1987.49	2809.13	1.413
003643507	SHAFT ASSEMBLY,FLEXIBLE	ARIMA(0,1,1)	5.11	21.77	4.260
002814163	MERCURIC NITRATE SOLUTION	LINEAR TREND	5.08	7.59	1.494
013124075	HYDRAZINE,REAGENT	ARIMA(0,1,1)	11.89	39.32	3.306
001752079	PAWL	ARIMA(0,0,1)	0.36	1.73	4.730
002278693	ELECTRON TUBE	ARIMA(0,0,1)	3.42	8.37	2.446
006551575	SWITCH,TOGGLE	ARIMA(0,0,1)	1.30	1.99	1.534
010711367	MOTOR-TACHOMETER GENERATOR	ARIMA(0,0,1)	1.20	4.14	3.448
001651958	PACKING PREFMD	ARIMA(0,0,1)	205.28	427.51	2.083
006551514	SWITCH,TOGGLE	LINEAR TREND	3.83	5.93	1.550
012449874	CIRCUIT CARD ASSEMBLY	ARIMA(0,0,1)	0.09	0.36	4.097
010260637	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	2.36	8.18	3.470
000069567	SEAT,VALVE	LINEAR TREND	101.75	161.82	1.590
003541443	GUIDE,VALVE STEM	ARIMA(0,1,1)	206.64	653.15	3.161
005990505	O-RING	4-QTR SIMPLE MA	143.81	1340.05	9.318
006246296	GASKET	ARIMA(0,0,1)	10.67	53.67	5.028
011175877	GASKET	ARIMA(0,1,1)	25.12	208.24	8.288
003918837	PLATE,VALVE	LINEAR TREND	18.72	26.30	1.405
003934889	CYLINDER SLEEVE	ARIMA(0,1,1)	21.71	58.98	2.716
002923482	GASKET	ARIMA(0,0,1)	2.16	5.03	2.334
014334347	COOLING WATER REGULATOR	LINEAR TREND	9.69	27.45	2.832

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002620286	ELECTRON TUBE	ARIMA(0,0,1)	12.11	21.02	1.735
002620218	ELECTRON TUBE	LINEAR TREND	9.45	13.13	1.390
008735015	SPACER-PSTN	ARIMA(0,1,1)	32.67	201.55	6.170
002810210	FUSE,CARTRIDGE	ARIMA(0,1,1)	19.55	111.81	5.719
009910938	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	20.10	28.27	1.406
012599803	VALVE	ARIMA(0,1,1)	1.10	49.81	45.475
006165522	KEY,WOODRUFF	LINEAR TREND	0.75	1.15	1.541
008800429	NOZZLE,FUEL INJECTION,NONAIRCR	LINEAR TREND	174.07	287.48	1.652
002186777	BEARING HALF,SLEEVE	4-QTR SIMPLE MA	8.81	58.99	6.694
002185938	SPINDLE,OIL PURIFIER	CONSTANT MEAN	11.19	14.08	1.259
000546675	SCREW,MACHINE	ARIMA(0,0,1)	0.12	0.37	3.096
002485478	LENS,LIGHT	ARIMA(0,0,1)	0.21	0.36	1.706
008897041	FIRING MECHANISM ASSEMBLY	LINEAR TREND	0.16	0.51	3.278
005995577	GASKET	ARIMA(0,1,1)	5174.25	19273.79	3.725
014151285	GASKET	ARIMA(0,0,1)	97.35	484.82	4.980
002761827	BEARING,WASHER,THRUST	LINEAR TREND	2.02	3.13	1.551
003838661	GASKET	4-QTR SIMPLE MA	3.28	38.72	11.800
006165514	KEY,WOODRUFF	ARIMA(1,0,0)	0.21	0.81	3.950
001565048	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	4.81	25.84	5.369
003643827	SPRING,EXPANDER,PISTON RING	LINEAR TREND	19.34	65.24	3.373
011144423	SYNTHESIZER	ARIMA(0,1,1)	0.16	0.93	5.731
002805039	FUSE,CARTRIDGE	ARIMA(1,0,0)	101.39	130.13	1.283
007261638	GASKET	ARIMA(0,1,1)	13.83	82.06	5.932
010892584	RETAINER,PACKING	ARIMA(0,0,1)	4121.58	5115.72	1.241
010402301	VANE,PUMP,ROTARY	ARIMA(0,1,1)	23.97	75.19	3.137
002804426	FUSE,CARTRIDGE	ARIMA(0,0,1)	272.24	459.37	1.687
002804429	FUSE,CARTRIDGE	ARIMA(0,0,1)	114.19	579.32	5.073
001106225	GASKET	ARIMA(0,1,1)	100.55	245.57	2.442
010136418	SWITCH,FLOW	LINEAR TREND	0.06	0.28	4.625
009873731	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	4.67	10.33	2.213
002184015	DIAPHRAGM,ACTUATOR	4-QTR SIMPLE MA	1.22	4.57	3.752
008356127	BRUSH,ELECTRICAL CONTACT	HOLT'S LINEAR	66.60	115.40	1.733
008506091	FUSE,CARTRIDGE	ARIMA(0,0,1)	0.14	6.66	47.659
009818914	GASKET-VL SCR	ARIMA(0,0,1)	28.67	51.28	1.789
001978536	PACKING MATERIAL	ARIMA(0,0,1)	302.03	1002.40	3.319
007245432	SEMICONDUCTOR DEVICE,THYRISTOR	ARIMA(0,1,1)	1.31	6.67	5.078
009903381	GASKET	LINEAR TREND	205.99	353.98	1.718
013387783	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	66.02	131.08	1.985
000076143	O-RING	ARIMA(0,0,1)	681.99	1278.18	1.874
010326028	SPACER,RING	ARIMA(0,0,1)	11.49	94.05	8.185
011669243	HOSE,NONMETALLIC	ARIMA(1,0,0)	988.27	1234.89	1.250
002789740	PIN,PISTON	ARIMA(0,0,1)	29.24	75.87	2.595
011979828	AIR DRYER ASSEMBLY	ARIMA(0,1,1)	1.26	3.63	2.871
002169537	GAGE,LIQUID QUANTITY,FLOAT TYP	ARIMA(0,0,1)	0.30	1.23	4.161
007324715	COIL,ELECTRICAL	ARIMA(0,1,1)	10.82	26.11	2.412
006610191	CABLE,RADIO FREQUENCY	ARIMA(0,1,1)	2655.86	12214.94	4.599

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
000312603	RETAINER,PACKING	ARIMA(0,0,1)	360.01	1589.48	4.415
002186833	SEAL ASSEMBLY	ARIMA(0,0,1)	0.52	2.84	5.509
003677235	BEARING,WASHER,THRUST	ARIMA(0,0,1)	117.10	204.35	1.745
005165915	VALVE,POPPET,ENGINE	ARIMA(0,0,1)	12.61	25.33	2.009
006882111	SCREW,CAP,HEXAGON HEAD	ARIMA(0,0,1)	81.79	304.03	3.717
005797925	O-RING	ARIMA(0,0,1)	3.47	23.23	6.687
008801293	TEMPERATURE INDICATING COMPOUN	LINEAR TREND	18.14	27.03	1.490
009380431	TEMPERATURE INDICATING COMPOUN	ARIMA(0,0,1)	10.14	18.55	1.829
004633787	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	0.07	0.37	5.491
005839610	LAMP,INCANDESCENT	LINEAR TREND	924.66	1320.86	1.428
006652881	FUSE,CARTRIDGE	ARIMA(1,0,0)	11.42	20.47	1.792
008022130	O-RING	ARIMA(0,1,1)	2.23	16.51	7.410
012060998	LAMP,INCANDESCENT	4-QTR SIMPLE MA	5.16	31.42	6.093
003643452	TUBE ASSEMBLY,METAL	LINEAR TREND	1.34	2.00	1.495
005013558	RIVET,SOLID	4-QTR SIMPLE MA	2.78	13.94	5.010
012450169	GASKET	ARIMA(0,1,1)	23.45	117.81	5.023
007077989	HOSE ASSEMBLY,NONMETALLIC	ARIMA(0,0,1)	0.31	1.62	5.292
005596182	O-RING	ARIMA(0,0,1)	4.41	29.19	6.623
006322669	BEARING,SLEEVE	ARIMA(0,1,1)	13.61	56.92	4.183
000500544	FUSE,CARTRIDGE	LINEAR TREND	5.83	8.82	1.514
000804578	CONNECTING ROD,PISTON	ARIMA(0,0,1)	1415.19	2502.82	1.769
000943552	BEARING,SLEEVE	ARIMA(0,0,1)	747.86	1864.67	2.493
005508694	MAGAZINE,CARTRIDGE	LINEAR TREND	5.47	8.72	1.593
007836519	BODY ASSEMBLY,LANTE	ARIMA(0,0,1)	6445.13	11621.86	1.803
009031524	NUT,PLAIN,HEXAGON	HOLT'S LINEAR	202.17	60.86	0.301
009361649	FUSE,CARTRIDGE	LINEAR TREND	28961.70	40312.04	1.392
005797914	O-RING	LINEAR TREND	28.93	40.55	1.402
001651946	O-RING	ARIMA(1,0,0)	1207.72	1585.02	1.312
001651966	PACKING-PREFMD ID 5.109	ARIMA(0,1,1)	5.99	21.35	3.566
001978535	PACKING MATERIAL	ARIMA(0,0,1)	13.41	49.56	3.696
001979673	PACKING MATERIAL	ARIMA(0,0,1)	0.43	2.82	6.538
002995962	STARTER,FLUORESCENT LAMP	ARIMA(0,0,1)	2814.55	5830.58	2.072
003934898	CYLINDER HEAD GASKET	ARIMA(0,0,1)	70.12	178.42	2.545
014449487	FUEL FILTER	ARIMA(0,1,1)	37.28	101.82	2.731
014606685	STARTER,ENGINE,AIR	LINEAR TREND	1.58	2.89	1.826
011932347	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,1,1)	1.07	4.12	3.841
006830560	LAMP,INCANDESCENT	ARIMA(0,0,1)	0.40	1.77	4.468
000113176	PLUG-PP	ARIMA(0,0,1)	0.88	3.05	3.482
002487950	STUD,PLAIN	LINEAR TREND	2.10	3.33	1.583
000759144	COIL,RADIO FREQUENCY	ARIMA(0,0,1)	7.41	16.27	2.197
000813536	RELAY,ELECTROMAGNETIC	ARIMA(0,0,1)	0.10	0.68	7.069
002669940	LAMP,INCANDESCENT	LINEAR TREND	1038.18	1339.20	1.290
008982101	DIODE	LINEAR TREND	4.61	6.56	1.424
010317030	MICROCIRCUIT	LINEAR TREND	8.33	12.37	1.486
003541227	SCREW,CAP,HEXAGON HEAD	ARIMA(0,0,1)	0.21	1.01	4.887
010744121	MICROCIRCUIT,DIGITAL	LINEAR TREND	1.34	2.00	1.495

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
011729712	SWITCH,FLOW	ARIMA(0,0,1)	0.38	1.05	2.740
008098544	WASHER,FLAT	LINEAR TREND	0.39	0.62	1.562
010452576	FILTER ELEMENT,FLUID	LINEAR TREND	2.19	3.40	1.552
011718067	SEAL ASSEMBLY,SHAFT	4-QTR SIMPLE MA	20.36	79.89	3.924
001727945	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	2.26	3.41	1.508
002465052	LAMP,INCANDESCENT	ARIMA(0,0,1)	61.26	386.25	6.305
002995546	LAMP,FLUORESCENT	ARIMA(0,0,1)	127.46	190.75	1.497
005263659	PLUG,ANODE RETAINING	4-QTR SIMPLE MA	1.09	9.01	8.240
008136054	ANODE,CORROSION PREVENTIVE	ARIMA(0,0,1)	33.87	199.50	5.889
000267123	MECHANISM	ARIMA(0,0,1)	0.28	0.99	3.479
000814219	WASHER,FLAT	4-QTR SIMPLE MA	4.33	34.60	7.993
001346064	ELECTRON TUBE	ARIMA(0,0,1)	17.30	41.47	2.398
001982079	BEARING,BALL,ANNULAR	LINEAR TREND	74.76	111.34	1.489
001993973	FUSE,CARTRIDGE	LINEAR TREND	0.22	0.34	1.527
004923357	GASKET	LINEAR TREND	130.97	201.57	1.539
006244718	ELECTRON TUBE	LINEAR TREND	26.39	48.44	1.835
002222565	RUBBER SHEET,SOLID	ARIMA(0,0,1)	0.91	3.25	3.572
000909621	GASKET	LINEAR TREND	294.39	394.41	1.340
002391877	GASKET	LINEAR TREND	6.68	9.82	1.471
002506435	LAMP,INCANDESCENT	ARIMA(0,0,1)	3.15	18.11	5.750
002804960	FUSE,CARTRIDGE	LINEAR TREND	12.48	20.42	1.636
002916712	GASKET	ARIMA(0,0,1)	565.42	961.87	1.701
004686840	CONTACT,ELECTRICAL	LINEAR TREND	1.22	1.77	1.448
003794327	GASKET SET	ARIMA(0,0,1)	11.85	34.24	2.889
005644712	SWITCH,SENSITIVE	ARIMA(1,0,0)	3.30	4.84	1.469
006551513	SWITCH,TOGGLE	LINEAR TREND	0.54	0.88	1.631
009146005	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,1,1)	8.13	16.94	2.083
000112304	PIPE PLUG	LINEAR TREND	10.36	15.77	1.523
005825965	WASHER 1 LOCK	CONSTANT MEAN	1.75	2.13	1.215
007616882	NUT,PLAIN,HEXAGON	CONSTANT MEAN	5.23	6.44	1.231
007679425	WASHER,FLAT	LINEAR TREND	952.83	1367.65	1.435
007680319	NUT,PLAIN,HEXAGON	LINEAR TREND	0.54	0.88	1.631
011464123	HOSE ASSEMBLY,NONMETALLIC	ARIMA(0,0,1)	1.26	6.56	5.190
001258074	SHAFT,LEVER	ARIMA(1,0,0)	2380.56	3642.99	1.530
002222566	RUBBER SHEET,SOLID	ARIMA(0,0,1)	0.78	2.71	3.481
006183223	PACKING MATERIAL	CONSTANT MEAN	176.61	209.91	1.189
007170169	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(1,0,0)	3.73	4.49	1.203
010762867	SPRING	ARIMA(0,0,1)	5.35	22.98	4.299
011176374	IMPELLER,FAN,AXIAL	ARIMA(0,0,1)	9.51	29.86	3.140
000739891	FILTER-DRIER,REFRIGERANT	ARIMA(0,0,1)	249.86	359.69	1.440
002929901	O-RING	ARIMA(0,0,1)	41.60	197.08	4.737
010933308	MICROCIRCUIT,DIGITAL	ARIMA(0,0,1)	5.70	18.61	3.265
011224286	RING SET,PISTON	ARIMA(0,0,1)	2.80	5.66	2.026
009525367	O-RING	ARIMA(1,0,0)	450.72	588.91	1.307
000363749	CAGE,VALVE	LINEAR TREND	0.89	1.85	2.072
008000541	ELECTRON TUBE	LINEAR TREND	17.08	28.39	1.662

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
013406151	SEAL MECHANICAL ASSY	ARIMA(0,0,1)	26.35	62.22	2.361
010585455	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	18.64	116.56	6.254
007850994	BUSHING,ROTOR POCKE	ARIMA(1,0,0)	3.43	5.50	1.602
000503280	BATTERY,NONRECHARGEABLE	ARIMA(1,0,0)	982.39	3981.66	4.053
002871931	FILTER ELEMENT,FLUID	ARIMA(0,1,1)	178.87	321.95	1.800
007827853	SWITCH,PRESSURE	ARIMA(0,0,1)	0.14	0.36	2.546
008493863	FUSE,CARTRIDGE	ARIMA(1,0,0)	23.10	32.99	1.428
011512783	O-RING	LINEAR TREND	87.70	121.11	1.381
002938120	BEARING,BALL,ANNULA	LINEAR TREND	0.39	0.62	1.562
002952735	BALLAST,LAMP	LINEAR TREND	2.89	4.32	1.491
002952838	FILTER,INDICATOR LIGHT	ARIMA(0,0,1)	1.00	3.03	3.039
007765920	HANDLE AND SWITCH,L	LINEAR TREND	87.08	125.78	1.444
012341320	FUSE,CARTRIDGE	ARIMA(0,1,1)	3.74	24.32	6.501
013553686	GASKET	ARIMA(0,0,1)	24.03	50.22	2.090
002805066	FUSE	4-QTR SIMPLE MA	0.34	3.54	10.286
002808344	FUSE,CARTRIDGE	LINEAR TREND	120.16	204.08	1.698
002849220	FUSE, CARTRIDGE	ARIMA(0,0,1)	2.17	9.68	4.463
003997035	WINDOW,LIGHTING FIXTURE	4-QTR SIMPLE MA	82.66	308.80	3.736
006159376	TOGGLE SWITCH	4-QTR SIMPLE MA	11.83	54.92	4.643
008034570	SWITCH,SENSITIVE	ARIMA(0,0,1)	0.74	3.35	4.510
008362564	LIGHT,INDICATOR	ARIMA(0,0,1)	3.20	5.87	1.838
013387831	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	33.34	208.30	6.248
009352235	CONNECTOR,PLUG,ELECTRICAL	4-QTR SIMPLE MA	1.02	11.30	11.125
012020474	FILTER ELEMENT,INTAKE AIR CLEA	ARIMA(0,0,1)	1.50	2.67	1.777
000506646	NUT,SELF-LOCKING,HEXAGON	ARIMA(0,0,1)	31.22	62.22	1.993
000546650	SCREW,MACHINE	ARIMA(0,0,1)	0.93	2.18	2.351
000871644	TUBING,NONMETALLIC,RIGID	LINEAR TREND	1.06	1.66	1.567
000941830	PIN,STRAIGHT,THREADED	ARIMA(0,0,1)	132.36	774.12	5.848
001048330	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.57	2.59	1.653
001048370	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	7.68	28.97	3.770
001133137	TERMINAL,LUG	LINEAR TREND	5.43	11.38	2.097
001139827	TERMINAL,LUG	ARIMA(1,0,0)	1.57	1.95	1.243
001140711	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.51	2.57	5.007
001434777	TERMINAL, TAG, RING	LINEAR TREND	1.32	2.13	1.614
001451148	LAMP,INCANDESCENT	ARIMA(0,0,1)	291.11	831.31	2.856
001522983	LAMP,FLUORESCENT	ARIMA(0,0,1)	2172.69	12371.00	5.694
001529574	CONTACT,ELECTRICAL	ARIMA(0,0,1)	1.16	2.64	2.282
001558663	LAMP,INCANDESCENT	ARIMA(0,0,1)	4.85	9.26	1.908
001558726	LAMP,INCANDESCENT	LINEAR TREND	1.60	2.24	1.394
001670721	WASHER,LOCK	LINEAR TREND	0.84	1.38	1.639
001670808	WASHER,FLAT	ARIMA(0,0,1)	48.21	68.84	1.428
001720025	FITTING,LUBRICATION	LINEAR TREND	3.17	4.91	1.547
001740968	WICK	LINEAR TREND	27.82	40.38	1.451
001791814	LAMP,GLOW	ARIMA(0,0,1)	4.34	8.91	2.051
003541227	SCREW,CAP,HEXAGON HEAD	ARIMA(0,0,1)	0.21	1.01	4.887
001834355	WASHER,FLAT	LINEAR TREND	0.75	1.15	1.541

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
002449276	RUBBER SHEET,SOLID	ARIMA(0,0,1)	1.53	4.03	2.641
002465060	LAMP,INCANDESCENT	ARIMA(0,0,1)	2625.91	10915.38	4.157
002483844	O-RING	LINEAR TREND	1.64	2.41	1.464
002758263	PIN,SPRING	ARIMA(0,0,1)	0.66	2.34	3.531
002805027	FUSE,CARTRIDGE	ARIMA(0,0,1)	36.55	65.76	1.799
002810225	FUSE,CARTRIDGE	ARIMA(0,0,1)	5.20	16.41	3.158
002835280	TERMINAL, LUG	LINEAR TREND	8.17	12.14	1.486
002911143	SPRING,HELICAL,COMPRESSION	ARIMA(0,0,1)	2313.87	6488.15	2.804
002959063	FUSE,CARTRIDGE	ARIMA(0,1,1)	14.17	34.95	2.467
002976119	GASKET	CONSTANT MEAN	36.25	45.38	1.252
003762241	GASKET	LINEAR TREND	0.39	0.62	1.562
005143394	WASHER,FLAT	ARIMA(0,0,1)	14019.80	30583.52	2.181
005157449	WASHER,FLAT	LINEAR TREND	6.68	9.82	1.471
005510433	GASKET	ARIMA(1,0,0)	0.54	0.95	1.767
005776214	SEMICONDUCTOR DEVICE,DIODE	LINEAR TREND	0.89	1.23	1.383
005822855	O-RING	ARIMA(0,0,1)	12504.00	38495.92	3.079
005950136	FILTER ELEMENT,AIR CONDITIONIN	LINEAR TREND	51.68	77.64	1.503
006255756	WASHER,FLAT	ARIMA(0,0,1)	0.36	1.73	4.730
006464631	FUSE,CARTRIDGE	LINEAR TREND	249.30	326.78	1.311
006902068	DIAPHRAGM,VALVE,FLAT	ARIMA(0,1,1)	0.13	0.78	5.798
007015079	SCREW,MACHINE	LINEAR TREND	141.29	214.04	1.515
007279486	O-RING	ARIMA(0,0,1)	6.67	13.45	2.015
007295499	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	7.39	23.67	3.202
007319191	DIAPHRAGM,VALVE,FLAT	ARIMA(0,1,1)	0.13	0.78	5.798
007381672	DESICCANT,ACTIVATED	LINEAR TREND	62.95	93.71	1.489
007533892	PIN,SPRING	ARIMA(0,0,1)	1.72	3.21	1.866
008037208	O-RING	LINEAR TREND	6168.61	8614.04	1.396
008097802	FUSE,CARTRIDGE	CONSTANT MEAN	290.19	362.88	1.251
008148360	WINDOW,LIGHTING FIXTURE	LINEAR TREND	9.72	13.11	1.350
008230482	BOOT,DUST AND MOISTURE SEAL	ARIMA(0,0,1)	0.81	4.61	5.681
008230751	FUSE,CARTRIDGE	LINEAR TREND	245.06	324.93	1.326
008238740	PIN,SPRING	LINEAR TREND	0.39	0.62	1.566
008423410	SCREW,SELF-LOCKING	ARIMA(0,0,1)	7.51	15.13	2.016
008426937	TRANSISTOR	CONSTANT MEAN	2.11	2.58	1.224
008554261	FUSE,CARTRIDGE	ARIMA(1,0,0)	243.96	324.27	1.329
008574960	NUT,SELF-LOCKING,HEXAGON	ARIMA(0,0,1)	1.17	2.19	1.866
008689847	BALLOON,TARGET	ARIMA(0,0,1)	0.25	0.70	2.752
008892589	NUT,SELF-LOCKING,HEXAGON	LINEAR TREND	0.75	1.15	1.541
009129375	FUSE,CARTRIDGE	ARIMA(0,0,1)	96.58	340.96	3.530
009289732	O-RING	CONSTANT MEAN	23.98	29.78	1.242
009349759	NUT,PLAIN,HEXAGON	LINEAR TREND	5.23	7.73	1.476
009349760	NUT,PLAIN,HEXAGON	LINEAR TREND	0.39	0.62	1.562
009474368	SCREW,MACHINE	LINEAR TREND	0.39	0.62	1.562
009482702	SWITCH,PUSH	LINEAR TREND	0.56	0.88	1.573
009847042	WASHER,LOCK	LINEAR TREND	4.08	6.30	1.543
010062129	O-RING	LINEAR TREND	274.73	376.06	1.369

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
010144915	HOSE,NONMETALLIC	ARIMA(0,0,1)	1.51	7.34	4.863
010294176	PROBE,SAFETY SHORTING	ARIMA(0,0,1)	6.04	22.22	3.679
010322111	ROD SEAL,U CUP	ARIMA(0,1,1)	37.25	93.08	2.499
010337581	HOSE ASSEMBLY,NONMETALLIC	LINEAR TREND	0.22	0.34	1.527
010348251	PACKING,PREFORMED	LINEAR TREND	597.58	824.95	1.380
010438883	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.58	2.49	4.294
010579151	SWITCH,REED	ARIMA(0,0,1)	0.37	0.70	1.902
010711299	SCREW,SELF-LOCKING	ARIMA(0,0,1)	0.88	3.36	3.835
012322325	FILTER ELEMENT,INTAKE AIR CLEA	ARIMA(0,0,1)	5.88	12.98	2.207
012734727	HOSE ASSEMBLY,NONME	LINEAR TREND	0.45	0.65	1.447
000826034	FILTER,FLUID	ARIMA(0,0,1)	1.31	4.97	3.781
007172162	GASKET	ARIMA(0,0,1)	2.70	12.01	4.446
00US22518	O-RING	ARIMA(0,0,1)	0.82	3.70	4.513
012008493	FILTER ELEMENT,FLUID	ARIMA(1,0,0)	14.51	20.51	1.413
008773157	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	3364.52	6490.68	1.929
010395357	PAD ASSEMBLY	ARIMA(1,0,0)	505.17	746.06	1.477
010385272	GASKET	ARIMA(0,0,1)	5.96	15.57	2.614
000053468	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.86	1.42	1.647
000090683	NUT,SELF-LOCKING,EXTENDED WASH	ARIMA(0,0,1)	47.06	125.04	2.657
001102970	WASHER,SPRING TENSION	ARIMA(0,0,1)	10335.50	18028.26	1.744
006163773	SEAL,GAS TURBINE	ARIMA(0,0,1)	53.22	77.75	1.461
006954347	THERMOSTAT,FLOW CONTROL	ARIMA(0,1,1)	1.31	3.06	2.334
010096742	GASKET	ARIMA(1,0,0)	30.82	52.43	1.701
000108159	CAPACITOR, TANTALUM	LINEAR TREND	0.58	0.91	1.576
000108192	CAPACITOR, TANTALUM	LINEAR TREND	0.58	0.91	1.576
000108498	CAPACITOR, CERAMIC	ARIMA(0,0,1)	0.46	0.69	1.494
000108717	CAPACITOR,FIXED,CERAMIC DIELEC	ARIMA(0,0,1)	8516.29	14887.39	1.748
003882610	FILTER ASSY,JET	ARIMA(0,0,1)	2.25	3.56	1.584
000514532	COIL,RADIO FREQUENCY	ARIMA(0,0,1)	1.26	2.41	1.909
000524578	TERMINAL-STUD	ARIMA(0,0,1)	0.16	0.67	4.042
000613211	CAPACITOR,FIXED,MICA DIELECTRI	LINEAR TREND	0.94	1.45	1.539
000643033	CONNECTOR,RECEPTACLE,ELECTRICA	ARIMA(0,0,1)	0.33	1.24	3.781
000818365	TRANSISTOR	LINEAR TREND	0.94	1.45	1.539
001048357	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.91	1.576
001048366	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	5.19	7.86	1.515
001048369	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.86	1.42	1.647
001057765	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.88	1.517
001063666	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	4.39	6.45	1.469
001063668	RESISTOR,FIXED COMP	LINEAR TREND	0.58	0.91	1.576
001069356	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.16	0.67	4.042
001069357	RESISTOR,FIXED,COMP	ARIMA(0,0,1)	0.16	0.67	4.042
001111679	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	5.48	15.56	2.841
001114727	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.86	1.42	1.647
001114845	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.94	1.45	1.539
002126330	GASKET	ARIMA(0,0,1)	1.25	6.15	4.926
001134863	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.33	1.24	3.781

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001137346	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.86	1.42	1.647
001140708	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.86	1.42	1.647
001158055	RESISTOR,FIXED,COMPOSITION	ARIMA(1,0,0)	1.57	1.95	1.243
001168554	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.43	1.66	3.833
001319729	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.91	1.576
001353972	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.91	1.576
001356046	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.91	1.576
001368431	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.28	0.99	3.479
001410742	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.75	1.15	1.541
001411183	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	2.61	3.71	1.421
001444383	CAPACITOR,TANTALUM	LINEAR TREND	0.58	0.91	1.576
001924789	JACK,TELEPHONE	LINEAR TREND	0.58	0.91	1.576
001927180	CAPACITOR, TANTALUM	LINEAR TREND	0.58	0.91	1.576
002111261	CAPACITOR,FIXED,ELECTROLYTIC	ARIMA(0,0,1)	0.16	0.67	4.042
002285506	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	1.39	2.19	1.575
002374054	CONTACT,ELECTRICAL	ARIMA(0,0,1)	0.65	0.69	1.073
000098856	POWER SUPPLY	ARIMA(0,0,1)	0.09	0.36	4.097
008626929	GASKET-EXH MFD	ARIMA(0,0,1)	10.03	30.33	3.023
009006401	HEADSET-CHEST SET,E	ARIMA(0,0,1)	132.05	207.46	1.571
001169927	ELECTRON TUBE	LINEAR TREND	16.19	27.55	1.702
006047920	PLUNGER,FUEL INJECTOR	ARIMA(1,0,0)	506.22	702.55	1.388
002722080	SCREW,MACHINE	LINEAR TREND	0.39	0.62	1.562
003696932	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.94	1.45	1.539
004117490	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.16	0.67	4.042
004351718	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.16	0.67	4.042
004854554	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.58	0.91	1.576
004935482	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	0.86	1.42	1.647
005009152	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.16	0.67	4.042
005562091	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	0.69	1.02	1.479
006233618	LAMP,INCANDESCENT	LINEAR TREND	3.07	4.88	1.588
000884675	SWITCH,TOGGLE	ARIMA(0,0,1)	92.46	126.84	1.372
001790051	RUBBER SHEET,SOLID,CLOTH INSER	LINEAR TREND	0.75	1.15	1.541
009260040	TERMINAL,STUD	ARIMA(0,0,1)	2.48	7.59	3.066
006474059	CAPACITOR,FIXED,CERAMIC DIELEC	LINEAR TREND	0.58	0.91	1.576
006551582	SWITCH,TOGGLE	ARIMA(0,0,1)	1.89	3.37	1.787
007103934	TRANSISTOR	ARIMA(0,0,1)	0.86	1.42	1.647
007235416	RELAY,ELECTROMAGNETIC	LINEAR TREND	0.58	0.91	1.576
000917843	RING,BEARING SEAL	ARIMA(0,0,1)	0.35	1.45	4.097
007630501	TRANSISTOR	LINEAR TREND	2.07	3.22	1.556
007816825	TRANSISTOR	LINEAR TREND	1.39	2.19	1.575
008114707	TRANSISTOR	ARIMA(0,0,1)	0.16	0.67	4.042
008288575	TRANSISTOR	LINEAR TREND	1.51	2.25	1.493
008379288	SEMICONDUCTOR DEVIC	ARIMA(0,0,1)	0.16	0.67	4.042
008852264	COVER,ELECTRICAL CONNECTOR	LINEAR TREND	0.58	0.91	1.576
004824195	INSERT,VALVE	ARIMA(0,1,1)	1883.99	9231.16	4.900
002272513	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	1.25	4.05	3.247

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
008920727	TRANSISTOR	ARIMA(0,0,1)	0.16	0.67	4.042
008923353	HEADSET,ELECTRICAL	LINEAR TREND	0.58	0.91	1.576
008923361	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	0.24	1.20	5.071
009074117	RESISTOR,VARIABLE,WIRE WOUND,P	ARIMA(0,0,1)	0.16	0.67	4.042
009310372	TRANSISTOR	ARIMA(0,0,1)	1.54	3.77	2.451
009381048	RESISTOR,VARIABLE,NONWIRE WOUN	ARIMA(0,0,1)	0.16	0.67	4.042
010298907	CAPACITOR, MICA	LINEAR TREND	0.94	1.45	1.539
010310447	CAPACITOR,FIXED,MICA DIELECTRI	LINEAR TREND	0.58	0.91	1.576
010435772	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.16	0.67	4.042
010436891	CAPACITOR,FIXED,MICA DIELECTRI	LINEAR TREND	0.58	0.91	1.576
010443579	CAPACITOR,FIXED,MICA DIELECTRI	LINEAR TREND	0.58	0.91	1.576
010448564	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.86	1.42	1.647
010580229	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.16	0.67	4.042
010631282	CAPACITOR,FIXED,ELECTROLYTIC	ARIMA(0,0,1)	1.00	4.06	4.082
010682674	CAPACITOR,FIXED,MICA DIELECTRI	ARIMA(0,0,1)	0.46	0.69	1.494
003643091	PARTS KIT,ENGINE BLOWER	ARIMA(0,0,1)	2.83	8.33	2.939
001651956	O-RING	LINEAR TREND	35.25	50.48	1.432
001675120	O-RING	4-QTR SIMPLE MA	12.84	30.52	2.376
005995781	GASKET,MANHOLE	ARIMA(0,0,1)	17.30	25.45	1.471
008263251	PIN,SPRING	LINEAR TREND	1.39	2.04	1.462
005292741	FILTER ELEMENT,FLUID	LINEAR TREND	38.07	58.33	1.532
000200203	PACKING,PREFORMED	ARIMA(0,0,1)	273.34	728.24	2.664
001651951	PACKING,PREFORMED	4-QTR SIMPLE MA	86.78	242.29	2.792
011273542	FUSE,CARTRIDGE	LINEAR TREND	4.08	5.98	1.467
002921605	SEAL,PLAIN ENCASED	LINEAR TREND	9.52	13.43	1.411
002805020	FUSE,CARTRIDGE	ARIMA(0,0,1)	3.53	18.94	5.363
005224315	SPACER,RING	ARIMA(0,0,1)	14.96	59.02	3.945
000108718	CAPACITOR, CERAMIC	LINEAR TREND	4.85	7.71	1.589
001135515	CAPACITOR, CERAMIC	ARIMA(0,0,1)	0.44	0.87	1.972
004320380	RESISTOR,FIXED,FILM	LINEAR TREND	1.39	0.87	0.625
006822477	TERMINAL,LUG	LINEAR TREND	38.07	2.28	0.060
008950461	BUSHING ASSEMBLY,DRAG	ARIMA(0,0,1)	273.34	5.43	0.020
010107562	CAPACITOR,FIXED,MIC	ARIMA(0,0,1)	0.44	0.87	1.972
010536833	CAPACITOR,FIXED,MICA DIELECTRI	LINEAR TREND	4.08	2.28	0.559
004554403	RESISTOR,FIXED,COMP	LINEAR TREND	9.52	0.63	0.067
009770485	LAMP,INCANDESCENT	ARIMA(0,0,1)	3.53	0.63	0.180
011706307	RELAY,ELECTROMAGNETIC	ARIMA(0,0,1)	14.96	3.01	0.201
000545643	SCREW,MACHINE	LINEAR TREND	4.85	1.15	0.237
001319915	FUSE,CARTRIDGE	ARIMA(0,0,1)	0.44	1.42	3.216
005956211	WASHER,FLAT	LINEAR TREND	1.32	2.28	1.730
007225998	WASHER,FLAT	LINEAR TREND	1.32	2.13	1.614
007526121	DIODE	LINEAR TREND	0.69	1.14	1.643
008156895	SEMICONDUCTOR DEVICE,DIODE	LINEAR TREND	0.73	1.16	1.576
011074954	O-RING	ARIMA(0,0,1)	47.31	104.71	2.213
006181603	O-RING	4-QTR SIMPLE MA	0.59	2.35	3.958
009282690	WASHER,LOCK	LINEAR TREND	0.84	1.38	1.639

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
009338118	WASHER,LOCK	LINEAR TREND	1.52	2.69	1.774
009349761	NUT	LINEAR TREND	8.11	12.33	1.520
009382013	NUT,PLAIN,HEXAGON	LINEAR TREND	1.32	2.13	1.614
009437572	TRANSISTOR	LINEAR TREND	0.36	0.61	1.712
011977106	FILTER ELEMENT,FLUID	LINEAR TREND	29.73	47.48	1.597
006026779	HARNESS,THERMOCOUPL	ARIMA(0,0,1)	0.47	2.14	4.558
001149491	BEARING,BALL,ANNULAR	LINEAR TREND	32.89	50.62	1.539
002570776	SPRING,HELICAL,COMPRESSION	ARIMA(0,1,1)	16.20	43.87	2.708
000917844	SEAL	ARIMA(0,0,1)	0.66	1.35	2.046
003685767	BEARING	ARIMA(0,0,1)	0.66	1.35	2.046
003685768	BEARING	ARIMA(0,0,1)	1.52	2.54	1.671
010709932	POWER AMPLIFIER ASSEMBLY	ARIMA(0,0,1)	0.38	0.63	1.671
000802012	LAMP,INCANDESCENT	4-QTR SIMPLE MA	536.88	1378.24	2.567
001999498	FUSE,CARTRIDGE	LINEAR TREND	105.59	141.42	1.339
004212916	SWITCH-THRMSTC	ARIMA(0,0,1)	0.38	0.63	1.671
008769216	CIRCUIT BREAKER	ARIMA(0,0,1)	11.10	16.33	1.471
007767217	FILTER ELEMENT-FDPRESS	ARIMA(1,0,0)	312.15	462.62	1.482
000999393	GASKET	ARIMA(0,0,1)	2944.23	5567.49	1.891
003649496	GASKET	ARIMA(0,0,1)	0.66	1.35	2.046
001661062	O-RING	ARIMA(1,0,0)	15.31	22.43	1.465
005383375	ELECTRON TUBE	LINEAR TREND	0.30	1.18	3.954
002366618	O-RING	LINEAR TREND	1.67	3.96	2.367
005420930	O-RING	LINEAR TREND	1.20	1.16	0.967
005840266	O-RING	ARIMA(0,1,1)	2795.30	6476.25	2.317
006186525	GASKET	ARIMA(0,1,1)	0.05	0.91	17.957
006243681	FILTER ELEMENT,FLUID	ARIMA(0,1,1)	0.11	0.75	6.880
001661084	O-RING	ARIMA(0,0,1)	4267.51	6037.71	1.415
001139828	TERMINAL, LUG	ARIMA(0,1,1)	1510.02	3568.29	2.363
000762104	PACKING WITH RETAINER	ARIMA(0,0,1)	0.97	1.92	1.984
001364162	TRANSISTOR	LINEAR TREND	4.43	6.68	1.508
001676330	MICROCIRCUIT	ARIMA(0,1,1)	16.92	47.79	2.825
001764928	LAMPHOLDER	ARIMA(0,1,1)	43.12	133.50	3.096
003393435	BEARING HALF,SLEEVE	ARIMA(0,0,1)	3.24	7.71	2.378
005859502	ASBESTOS SHEET	ARIMA(0,0,1)	0.68	3.21	4.744
005999549	PACKING MATERIAL	LINEAR TREND	169.55	258.60	1.525
008372406	SEMICONDUCTOR DEVICE,THYRISTOR	ARIMA(0,0,1)	204.75	376.04	1.837
010059266	CONNECTOR,PLUG,ELECTRICAL	ARIMA(0,0,1)	0.06	0.31	4.975
012449759	POWER AMP ASSY	LINEAR TREND	0.17	0.29	1.653
014134857	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	259.26	519.16	2.002
003761545	COOLER,FLUID,INDUSTRIAL	ARIMA(0,1,1)	0.51	2.95	5.772
009516126	SEMICONDUCTOR DEVICE SET	ARIMA(0,0,1)	6.46	13.35	2.067
010685210	WATER SAMPLING TEST REAGENT,DI	ARIMA(0,0,1)	230.77	363.63	1.576
000738939	BATTERY,NONRECHARGEABLE	ARIMA(0,0,1)	3526.54	6412.17	1.818
001719233	GASKET	ARIMA(1,0,0)	14.78	19.61	1.327
003541283	DISK,VALVE	ARIMA(0,0,1)	0.15	0.68	4.638

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
001444381	CAPACITOR, TANTULUM	LINEAR TREND	1.09	1.71	1.570
001798478	TRANSISTOR	ARIMA(0,0,1)	0.43	1.01	2.338
008921009	DIODE, ZENER	LINEAR TREND	0.82	1.20	1.474
010192736	STRAINER ELEMENT,SEDIMENT	ARIMA(0,0,1)	2.51	5.28	2.101
010277616	SWITCH,FLOW	ARIMA(0,1,1)	0.13	1.09	8.445
010495782	STRAINER ELEMENT,SEDIMENT	ARIMA(1,0,0)	12.12	16.82	1.388
010581881	IGNITER,SPARK,GAS TURBINE ENGI	4-QTR SIMPLE MA	2.11	5.11	2.424
010987607	O-RING	4-QTR SIMPLE MA	0.47	0.67	1.438
011169741	SPACER,VANE	LINEAR TREND	313.08	455.30	1.454
011275856	HOSE ASSEMBLY,METALLIC	ARIMA(0,0,1)	2.96	7.28	2.457
013821429	GASKET	ARIMA(0,0,1)	1.81	4.03	2.221
003902173	CYLINDER HEAD,DIESEL ENGINE	ARIMA(0,0,1)	48.07	172.17	3.582
002500224	O-RING	ARIMA(0,0,1)	38.14	69.35	1.818
009738965	PACKING,PREFORMED	ARIMA(1,0,0)	168.62	216.79	1.286
009817131	SEAL ASSEMBLY,PLAIN	ARIMA(0,1,1)	5.24	14.21	2.711
006780260	BELLOWS ASSEMBLY	ARIMA(0,0,1)	0.32	1.85	5.798
010873004	BEARING	ARIMA(0,0,1)	15.67	31.96	2.040
008341418	PIN,STRAIGHT,HEADLESS	ARIMA(0,0,1)	158.54	294.13	1.855
001741365	CANISTER,OXYGEN GEN	ARIMA(0,0,1)	19274.20	33178.12	1.721
010445034	ANTISEIZE COMPOUND	ARIMA(0,1,1)	20.17	56.34	2.793
005468637	CORROSION PREVENTIVE COMPOUND	ARIMA(0,1,1)	0.92	9.48	10.337
00US05464	RUBBER CAP FR	ARIMA(0,0,1)	1.20	3.55	2.960
00US02706	AMPLIFIER MITEG	ARIMA(0,0,1)	0.22	1.01	4.510
003131048	BELTS,V,MATCHED SET	ARIMA(0,1,1)	10.09	27.91	2.765
010375246	SPRING	ARIMA(0,0,1)	26.65	81.36	3.053
006123110	ENGINE BLOCK ASSEMBLY,DIESEL	ARIMA(0,0,1)	2.98	7.20	2.414
002008465	DISK,VOLTAGE REGULATOR	LINEAR TREND	76.64	113.38	1.479
000431167	ENTRANCE UNIT,GUN SYSTEM	ARIMA(0,1,1)	0.10	0.28	2.793
002278555	BATTERY,STORAGE	LINEAR TREND	26.24	34.69	1.322
011956908	SPARK PLUG	ARIMA(0,0,1)	2.15	3.45	1.600
007108488	RING,OIL,SEAL	ARIMA(0,0,1)	59.99	118.62	1.977
005422048	FACESHIELD,INDUSTRI	ARIMA(0,1,1)	13.12	35.25	2.687
011130110	SODA LIME,REAGENT	ARIMA(0,0,1)	387.25	554.11	1.431
000805813	CYLINDER SLEEVE	LINEAR TREND	665.07	945.35	1.421
000806161	ROCKER ARM,ENGINE POPPET VALVE	4-QTR SIMPLE MA	75.83	199.37	2.629
000806261	ROCKER ARM,ENGINE POPPET VALVE	4-QTR SIMPLE MA	21.05	55.36	2.630
000806263	PARTS KIT,ENGINE ROCKER ARM	LINEAR TREND	2319.57	3002.37	1.294
001894887	VALVE,GLOBE	ARIMA(0,0,1)	0.40	1.62	4.030
002170896	SHOCKMOUNT	4-QTR SIMPLE MA	0.80	3.87	4.859
003400880	VALVE ASSEMBLY	ARIMA(0,1,1)	4.05	10.04	2.480
003413674	RING SET,PISTON	4-QTR SIMPLE MA	62.20	193.53	3.111
003688290	RING SET,PISTON	ARIMA(0,1,1)	12.99	37.30	2.871
004060551	SPRING	ARIMA(1,0,0)	45.25	64.87	1.434
003643859	GASKET	ARIMA(1,0,0)	12.99	18.81	1.448
004834078	IMPELLER,PUMP,CENTRIFUGAL	ARIMA(1,0,0)	5.56	7.91	1.423

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
010146650	VALVE,SOLENOID	ARIMA(0,1,1)	0.82	2.27	2.782
010147459	CONNECTING ROD,PISTON	ARIMA(0,0,1)	202.99	597.12	2.942
010151836	RETAINER,PISTON PIN	ARIMA(0,1,1)	53.77	140.74	2.617
010272306	PLATE,WEAR,ROTARY PUMP	4-QTR SIMPLE MA	1.14	4.71	4.127
010395972	VALVE,SAFETY RELIEF	ARIMA(0,0,1)	32.33	91.20	2.821
010627387	SWITCH,PRESSURE	ARIMA(0,0,1)	0.14	0.33	2.357
010654691	CIRCUIT CARD ASSEMBLY	ARIMA(0,0,1)	0.09	0.33	3.584
010671809	RING SET,PISTON	LINEAR TREND	681.20	979.07	1.437
010698605	SWITCH,PRESSURE	ARIMA(0,1,1)	0.53	1.37	2.585
010915538	VALVE,CHECK	ARIMA(0,0,1)	16.57	43.64	2.634
010938370	SWITCH,FLOW	ARIMA(0,0,1)	0.15	0.28	1.879
011070540	RING,MATING	LINEAR TREND	10.31	14.85	1.440
011149283	INSERT,ENGINE VALVE SEAT	ARIMA(0,0,1)	0.88	4.86	5.513
011150652	INSERT,ENGINE VALVE SEAT	ARIMA(1,0,0)	1.56	4.86	3.117
011177589	SLEEVE ASSEMBLY	ARIMA(0,0,1)	446.87	2981.65	6.672
011184262	RING SET,PISTON	ARIMA(0,0,1)	0.07	0.32	4.284
011259675	GUIDE	LINEAR TREND	88.48	128.77	1.455
011368726	BRIDGE,VALVE	ARIMA(0,0,1)	173.62	234.62	1.351
011505442	DIAPHRAGM,VALVE,FLAT	4-QTR SIMPLE MA	20.70	55.38	2.675
011547192	SWITCH UNIT,LAST ROUND	ARIMA(0,1,1)	0.26	0.71	2.693
011605200	SWITCH,WAVEGUIDE	ARIMA(0,1,1)	0.22	0.57	2.590
011787159	DISK,VALVE	LINEAR TREND	269.23	385.68	1.433
011904156	VALVE,FLUSH	ARIMA(0,1,1)	0.06	0.26	4.503
011937703	FAN,CENTRIFUGAL	ARIMA(0,0,1)	0.09	0.34	3.905
012020615	DISK,VALVE	ARIMA(1,0,0)	124.57	190.86	1.532
012188171	SWITCH SUBASSEMBLY	LINEAR TREND	0.17	0.29	1.653
012205416	RING,PISTON	ARIMA(0,0,1)	310.97	608.43	1.957
012296266	PISTON,INTERNAL COMBUSTION ENG	LINEAR TREND	409.74	602.97	1.472
012812934	SEMICONDUCTOR DEVICE ASSEMBLY	LINEAR TREND	14.20	19.19	1.351
011726026	HEAT SINK ASSEMBLY	ARIMA(0,1,1)	0.09	0.98	10.824
011887309	RESOLVER ASSEMBLY	ARIMA(0,0,1)	0.22	0.32	1.496
012010918	RESOLVER ASSEMBLY	ARIMA(0,0,1)	0.11	0.62	5.817
012051247	VALVE,AIR DISCHARGE	ARIMA(0,0,1)	0.17	0.65	3.748
011567472	KIT,PRESSURE CARTRI	ARIMA(0,1,1)	8.76	26.34	3.007
009170772	LAMP,INCANDESCENT	ARIMA(0,0,1)	17.37	81.64	4.700
001434780	TERMINAL,LUG	LINEAR TREND	1.99	3.25	1.635
004054485	PEN,RECORDING	ARIMA(0,0,1)	0.65	2.33	3.561
004054486	PEN,RECORDING	ARIMA(0,0,1)	0.65	2.33	3.561
000113658	ELECTRON TUBE	ARIMA(0,0,1)	0.77	3.25	4.248
010603348	CIRCUIT CARD ASSEMBLY	4-QTR SIMPLE MA	0.20	0.72	3.522
010684844	CIRCUIT CARD ASSEMBLY	LINEAR TREND	0.31	0.59	1.904
010685032	ELECTRON TUBE	ARIMA(0,1,1)	0.74	2.92	3.950
010692009	ELECTRON TUBE	ARIMA(1,0,0)	2.67	4.46	1.672
008682584	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	0.97	2.27	2.355
013387781	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	46.66	126.58	2.713

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
000806327	SEAT,HELICAL COMPRESSION SPRIN	ARIMA(0,1,1)	13.28	35.32	2.660
001849108	VALVE,GATE	ARIMA(0,0,1)	1.94	2.75	1.418
002222562	ASBESTOS SHEET,COMPRESSED	ARIMA(0,0,1)	0.34	1.83	5.333
002969361	SWITCH,SENSITIVE	ARIMA(0,0,1)	354.91	550.18	1.550
003549762	POWER SENSOR	ARIMA(0,1,1)	0.10	1.00	9.930
004415124	DIAPHRAGM,ACTUATOR VALVE,SPECI	LINEAR TREND	1.26	1.99	1.581
004537756	SPRAY TIP,NOZZLE,FUEL INJECTOR	LINEAR TREND	3020.61	4391.90	1.454
005263680	PLUG,ANODE RETAINING	LINEAR TREND	0.70	1.15	1.653
005425191	UNION,PIPE	ARIMA(0,0,1)	8.50	17.76	2.090
008408849	HANDSET	ARIMA(0,0,1)	0.53	1.24	2.342
008653005	CONNECTING ROD,PISTON	ARIMA(0,1,1)	112.90	387.76	3.435
008883350	SEAL,PLAIN	LINEAR TREND	3.32	4.65	1.400
009026689	BELT,POSITIVE DRIVE	LINEAR TREND	0.47	0.85	1.828
010189466	PLUG,TUBE FITTING,THREADED	4-QTR SIMPLE MA	0.97	2.25	2.320
010256149	PISTON AND ROD ASSE	ARIMA(0,0,1)	0.48	0.70	1.460
010651823	SEAT,INJECTION	ARIMA(0,0,1)	3010.53	4130.58	1.372
010763720	IMPELLER,FAN,CENTRIFUGAL	ARIMA(0,0,1)	0.38	0.98	2.590
010914361	BLOWER ASSEMBLY	ARIMA(0,0,1)	0.16	0.66	4.144
010932793	VALVE,SOLENOID	ARIMA(0,1,1)	0.74	1.33	1.795
011000516	CONNECTING ROD,PISTON	ARIMA(0,0,1)	0.48	0.70	1.460
011169734	SPACER,VANE	LINEAR TREND	312.99	450.11	1.438
011169739	SPACER,VANE	LINEAR TREND	310.44	449.85	1.449
011169740	SPACER,VANE	LINEAR TREND	313.08	455.30	1.454
011259855	SHAFT	ARIMA(0,0,1)	42.62	191.23	4.487
011887816	LIMITER,PASSIVE	ARIMA(0,1,1)	0.26	0.71	2.693
012287409	SLAT,DOOR	LINEAR TREND	2.83	4.50	1.592
012388490	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,1,1)	14.18	66.31	4.677
012846605	BAND,ASSEMBLY	ARIMA(0,0,1)	4.88	15.95	3.270
012942148	SPACER,VANE	ARIMA(1,0,0)	247.02	351.91	1.425
012944170	SPACER,VANE	ARIMA(1,0,0)	247.02	351.91	1.425
012944173	SPACER,VANE	ARIMA(1,0,0)	247.02	351.91	1.425
014120914	SPACER,SPECIAL SHAPED	LINEAR TREND	246.58	351.81	1.427
010253354	KIT,POWER SUPPLY,CO	ARIMA(0,0,1)	0.49	0.68	1.365
006282893	BLADDER,ACCUMULATOR,HYDRAULIC	ARIMA(0,0,1)	1.03	4.48	4.365
009910945	BEARING,BALL,ANNULAR	LINEAR TREND	6.64	8.93	1.344
006413932	PACKING,PREFORMED	ARIMA(0,0,1)	509.61	1042.42	2.046
010329189	PACKING,PREFORMED	4-QTR SIMPLE MA	0.33	2.27	6.903
011881619	CIRCUIT CARD ASSEMBLY	LINEAR TREND	0.17	0.29	1.653
002550166	LIGHT,MARKER,DISTRESS	ARIMA(0,0,1)	26.27	48.14	1.832
013841998	TRANSISTOR	ARIMA(0,1,1)	3.54	131.16	37.080
006628984	BEARING HALF SET,SLEEVE	ARIMA(0,1,1)	201.20	604.45	3.004
007670508	PARTS KIT,ENGINE WATER PUMP	ARIMA(0,0,1)	22.84	94.31	4.129
001982418	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	2.99	7.43	2.485
013943480	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	3.30	14.46	4.384
002274110	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	2.09	12.67	6.052

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
005169199	VALVE,POPPET,ENGINE	4-QTR SIMPLE MA	251.44	924.55	3.677
011547845	SENCER OXYGEN	ARIMA(0,0,1)	2471.15	4929.35	1.995
012050805	DETECTOR,GAS	LINEAR TREND	8.27	12.56	1.519
008420859	PARTS KIT,ENGINE POPPET VALVE	ARIMA(0,0,1)	1003.10	1665.31	1.660
009285593	SYNCHRO,CONTROL TRANSFORMER	ARIMA(0,0,1)	0.17	0.65	3.748
008091997	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	0.68	1.97	2.895
013387785	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	56.14	122.55	2.183
002212650	WIRE,NONELECTRICAL	4-QTR SIMPLE MA	16.97	86.38	5.091
002276179	FUSE	LINEAR TREND	39.41	52.94	1.343
004876399	SEAL	ARIMA(0,1,1)	5.10	20.54	4.028
010739891	TUBE,PISTON GUIDE	ARIMA(0,1,1)	2.22	6.95	3.130
002635173	O-RING	ARIMA(0,1,1)	1.92	5.80	3.012
008575861	GASKET,SPIRAL WOUND	4-QTR SIMPLE MA	314.13	1417.26	4.512
010123066	CONNECTOR,PLUG,ELECTRICAL	ARIMA(0,0,1)	35.74	63.61	1.780
002476877	GASKET	ARIMA(0,0,1)	171.58	938.11	5.468
003794295	GASKET SET	LINEAR TREND	105.70	143.82	1.361
003902127	LINER ASSEMBLY,CYLINDER	4-QTR SIMPLE MA	153.75	502.58	3.269
009789564	VALVE,POPPET,ENGINE	LINEAR TREND	22.67	38.10	1.681
003902168	VALVE,CHECK	LINEAR TREND	102.14	135.61	1.328
008997533	TACHOMETER,MECHANICAL,FIXED MO	ARIMA(0,0,1)	2.87	7.67	2.671
003643787	HEAD,CYLINDER,ENGIN	ARIMA(0,0,1)	424.44	837.90	1.974
005430977	CONTACT,ELECTRICAL	ARIMA(0,0,1)	168.19	354.34	2.107
010684706	PUMP,ROTARY	ARIMA(0,0,1)	0.21	1.28	6.040
010883505	VALVE,REGULATING,FLUID PRESSUR	LINEAR TREND	2.01	2.81	1.398
011147896	BOARD,CIRCULAR	4-QTR SIMPLE MA	13.70	55.69	4.064
011183168	VALVE,SOLENOID	ARIMA(0,0,1)	9.85	20.18	2.049
011337411	STATOR,SUCTION,PUMP	ARIMA(0,1,1)	6.13	14.65	2.390
012465304	WIRING HARNESS,BRANCHED	ARIMA(0,1,1)	0.09	0.33	3.562
013151166	RECTIFIER,METALLIC	LINEAR TREND	1.26	1.99	1.582
001588243	BEARING-B ANN	ARIMA(0,1,1)	0.39	26.81	69.267
011638714	VERTICAL REFERENCE	ARIMA(0,0,1)	0.06	0.31	4.975
000621438	BOLT,EXTERNALLY RELIEVED BODY	LINEAR TREND	1996.79	2899.17	1.452
000904699	GASKET	ARIMA(0,0,1)	57.43	740.30	12.890
010682262	GASKET	ARIMA(0,0,1)	45.45	125.45	2.760
005011749	SWITCH,PUSH	LINEAR TREND	0.39	0.62	1.580
003541532	INSERT,ENGINE VALVE SEAT	ARIMA(0,1,1)	1060.60	2465.30	2.324
000017829	FILTER ELEMENT,FLUID	LINEAR TREND	24.50	36.16	1.476
000440357	GASKET	ARIMA(0,0,1)	0.16	0.92	5.807
000701925	FILTER ELEMENT,FLUID	LINEAR TREND	0.35	0.60	1.681
000937060	O-RING	LINEAR TREND	62.79	91.49	1.457
001077580	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	0.55	1.67	3.058
001434794	TERMINAL,LUG	ARIMA(0,0,1)	0.26	0.67	2.610
001448631	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	0.52	2.87	5.550
001651961	O-RING	LINEAR TREND	5.24	7.54	1.438
002880878	BEARING HALF,SLEEVE	4-QTR SIMPLE MA	1.09	5.97	5.462

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
001651965	O-RING	LINEAR TREND	87.85	124.36	1.416
001675116	O-RING	4-QTR SIMPLE MA	2.28	3.69	1.619
001675146	PACKING,PREFORMED	ARIMA(0,1,1)	5.25	16.55	3.153
001714506	CHAIN,BEAD	ARIMA(0,0,1)	1.06	3.10	2.918
002449277	RUBBER SHEET,SOLID	ARIMA(0,0,1)	3.54	13.23	3.740
002782523	CLAMP,HOSE	4-QTR SIMPLE MA	1.77	5.69	3.221
002938979	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	30.20	115.96	3.839
002984000	SEAL ASSEMBLY,SHAFT,SPRING LOA	LINEAR TREND	0.86	1.24	1.432
003007749	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	0.88	4.86	5.513
004549564	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	6.26	32.69	5.218
005290394	BELT,V	ARIMA(0,0,1)	48.54	163.09	3.360
010044887	PACKING,PREFORMED	ARIMA(0,0,1)	127.57	278.87	2.186
010046783	PACKING	ARIMA(0,1,1)	30.66	66.05	2.155
010083010	SEAL FACE	ARIMA(0,0,1)	1.20	2.25	1.871
010264270	SEAL	4-QTR SIMPLE MA	13.91	79.62	5.725
010292502	TRANSDUCER,MOTIONAL PICKUP	ARIMA(0,0,1)	0.17	0.65	3.748
010452938	O-RING	LINEAR TREND	58.77	81.74	1.391
010528958	SEAL	ARIMA(0,1,1)	28.15	83.56	2.969
010844753	O-RING	LINEAR TREND	6174.14	8252.42	1.337
010888911	GASKET	LINEAR TREND	0.83	1.88	2.267
011174731	SEAL	ARIMA(0,0,1)	5.54	23.55	4.255
011225719	GASKET	LINEAR TREND	22.10	32.31	1.462
011264424	SEAL	4-QTR SIMPLE MA	15.75	35.69	2.266
011276741	BELTS,V,MATCHED SET	LINEAR TREND	262.57	340.11	1.295
011547947	HOSE,COUPLING	LINEAR TREND	32.75	47.81	1.460
011692843	FILTER ELEMENT,INTAKE AIR CLEA	LINEAR TREND	44.57	73.68	1.653
011750044	TRANSFORMER,POWER	ARIMA(0,1,1)	0.25	9.90	39.490
012000490	GASKET	ARIMA(0,0,1)	4.14	12.54	3.028
012078886	RELAY,ELECTROMAGNETIC	ARIMA(0,0,1)	0.96	4.11	4.275
012225909	BEARING,BALL,DUPLEX	ARIMA(0,0,1)	5.00	28.09	5.619
004709644	BUSHING,SLEEVE	ARIMA(0,1,1)	2.92	12.58	4.316
013387830	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	57.09	195.90	3.431
002920816	SEAL,PLAIN ENCASED	ARIMA(0,0,1)	40.70	94.61	2.324
010912648	BEARING SET,SLEEVE	ARIMA(0,0,1)	313.22	591.93	1.890
006608711	CABLE,RADIO FREQUEN	LINEAR TREND	8.19	14.04	1.713
002996126	LAMP	LINEAR TREND	16.89	26.30	1.557
003772472	CORE,RADIATOR	ARIMA(0,0,1)	8.97	33.86	3.777
006182020	GASKET AND PREFORMED PACKING S	4-QTR SIMPLE MA	9.42	32.39	3.438
006170565	GUARD,LAMP	4-QTR SIMPLE MA	4.06	13.91	3.423
010159551	PACKING,SLEEVE	ARIMA(0,1,1)	16.44	62.42	3.797
010921220	COUPLING,SHAFT,FLEXIBLE	ARIMA(0,1,1)	0.43	2.21	5.180
000581978	RETAINING RING	4-QTR SIMPLE MA	3.31	20.37	6.149
012126298	MIXER ASSEMBLY	ARIMA(0,0,1)	0.22	0.32	1.496
013387786	GASKET,SPIRAL WOUND	ARIMA(0,0,1)	0.62	2.48	3.991
001880968	ELECTRON TUBE	4-QTR SIMPLE MA	0.67	2.46	3.658

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
005447933	TERMINAL,SPRING	4-QTR SIMPLE MA	65.63	405.19	6.174
007151152	RING,RETAINING	4-QTR SIMPLE MA	830.84	5009.22	6.029
012002814	HOSE ASSEMBLY,NONMETALLIC	ARIMA(0,1,1)	1.60	3.41	2.138
008758252	RING-SEP 4TH STG PSTN	ARIMA(0,1,1)	70.02	166.49	2.378
000991060	IMPELLER,PUMP,CENTRIFUGAL	ARIMA(0,1,1)	27.55	66.64	2.419
001345994	ELECTRON TUBE	4-QTR SIMPLE MA	1.03	4.95	4.800
001448499	BEARING,BALL,ANNULAR	ARIMA(0,0,1)	0.34	0.70	2.025
005543295	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	6.34	25.15	3.964
003456074	PARTS KIT,ENGINE ROCKER ARM	4-QTR SIMPLE MA	37.03	126.00	3.403
003541418	DAMPENER,VIBRATION,ENGINE	ARIMA(0,1,1)	22.92	67.64	2.952
006080490	VALVE,FUEL INJECTOR	ARIMA(0,1,1)	7.60	27.78	3.656
001588265	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	0.91	27.90	30.541
004451388	BRUSH,ELECTRICAL CONTACT	ARIMA(0,0,1)	23.64	45.74	1.935
005545311	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	0.97	2.05	2.112
003393440	BEARING,SLEEVE	ARIMA(0,0,1)	5.05	12.34	2.445
008021859	SPRING,HELICAL,COMPRESSION	LINEAR TREND	211.02	297.97	1.412
011168763	SEMICONDUCTOR DEVICE SET	LINEAR TREND	507.27	703.10	1.386
006181920	O-RING	ARIMA(0,0,1)	26.57	43.66	1.643
010615964	VALVE,REGULATING,FLUID PRESSUR	LINEAR TREND	3.47	22.45	6.477
003808997	COTTER	ARIMA(0,0,1)	0.06	0.31	4.975
002483835	O-RING	LINEAR TREND	164.05	300.99	1.835
011428668	SCREW,CAP,HEXAGON HEAD	ARIMA(0,0,1)	14.17	102.08	7.205
010194513	FILTER ELEMENT FLUI	ARIMA(0,1,1)	10.75	27.58	2.565
009349757	NUT,PLAIN,HEXAGON	ARIMA(0,0,1)	0.14	0.33	2.357
006629101	BEARING HALF SET,SLEEVE	ARIMA(0,0,1)	115.15	399.14	3.466
00US12852	PUMP INJECTION	4-QTR SIMPLE MA	0.33	2.27	6.903
005189611	TERMINAL BOARD	LINEAR TREND	2.33	3.80	1.632
000141328	BELLOWS,PRESSURE	ARIMA(0,1,1)	5.11	17.42	3.410
009859024	ANTENNA	ARIMA(0,0,1)	0.57	3.15	5.539
002440191	RUBBER SHEET,SOLID	ARIMA(0,0,1)	0.86	4.95	5.737
010134031	BEARING,BALL,ANNULAR	4-QTR SIMPLE MA	0.81	3.72	4.584
000057991	TRANSLATOR SYNTHESIZER ASSEMBL	ARIMA(0,0,1)	0.09	0.33	3.584
000784721	AMPLIFIER,RADIO FREQUENCY	ARIMA(1,0,0)	0.40	1.29	3.243
002708471	PAPER-GSKT 3-32 THK	4-QTR SIMPLE MA	5.92	40.69	6.871
005854126	RING SET,PISTON	LINEAR TREND	477.70	653.02	1.367
007771756	CYLINDER HEAD,DIESEL ENGINE	ARIMA(0,0,1)	2.01	5.84	2.900
001588269	BEARING,BALL,ANNULAR	LINEAR TREND	40.73	52.97	1.301
004270603	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	120.64	445.71	3.695
003541572	VALVE ASSEMBLY,FUEL INJECTOR	ARIMA(0,0,1)	144.75	258.67	1.787
006902284	DISK,DISCHARGE VALVE	ARIMA(0,0,1)	4.46	9.20	2.062
003538237	GASKET	ARIMA(0,0,1)	523.34	1920.31	3.669
000712319	INJECTOR ASSEMBLY	ARIMA(0,0,1)	9.45	25.62	2.710
002708466	PAPER,GASKET	ARIMA(0,0,1)	32.72	187.16	5.720
002004445	SPRING,HELICAL,COMPRESSION	LINEAR TREND	183.55	263.62	1.436
006101882	THERMOMETER,INDICATING,CAPILLA	ARIMA(0,0,1)	0.10	0.68	6.865

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
008139360	TRANSISTOR	ARIMA(0,0,1)	22.14	76.58	3.459
012371754	RING SET,PISTON	LINEAR TREND	2.79	4.61	1.653
010043610	BUSHING-AND-STUD CPL	ARIMA(1,0,0)	45.25	64.87	1.434
000018260	SEAL	ARIMA(0,0,1)	17.50	56.67	3.239
000691634	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	274.04	578.54	2.111
000904543	GASKET	LINEAR TREND	5.56	8.17	1.469
000904598	SEAL	ARIMA(0,0,1)	4.29	22.20	5.180
000904690	GASKET	LINEAR TREND	22.10	32.31	1.462
000914469	GASKET	LINEAR TREND	13.64	20.06	1.470
000927142	SEAL	LINEAR TREND	6.25	8.90	1.424
000927143	SEAL	LINEAR TREND	6.25	8.90	1.424
000927188	GASKET	LINEAR TREND	0.17	0.29	1.653
000937352	RING,SEAL	ARIMA(0,0,1)	28.70	69.40	2.418
000937355	RING	LINEAR TREND	21.50	32.00	1.488
000944322	RING,SEAL	LINEAR TREND	17.27	25.48	1.475
000956655	SEAL	ARIMA(0,0,1)	35.48	70.32	1.982
000956661	GASKET	ARIMA(0,0,1)	0.79	3.85	4.852
000957077	GASKET	LINEAR TREND	25.25	36.47	1.445
002761846	PARTS KIT,ENGINE WATER PUMP	LINEAR TREND	76.83	100.08	1.303
005655092	DIODE	ARIMA(0,0,1)	2.29	8.42	3.684
007836251	RELAY,LANTERN	ARIMA(0,0,1)	8.74	22.30	2.551
010126202	FUSE,CARTRIDGE	ARIMA(0,0,1)	33.20	84.79	2.554
010681822	GASKET	ARIMA(0,0,1)	135.49	273.82	2.021
010685722	GASKET	ARIMA(0,0,1)	24.89	54.99	2.209
010831945	KIT GASKET BLOWER	LINEAR TREND	20.57	31.57	1.535
010940043	GASKET	LINEAR TREND	0.17	0.29	1.653
011149709	GASKET	LINEAR TREND	223.53	316.21	1.415
011264494	CONNECTOR	LINEAR TREND	1606.20	2339.18	1.456
012134563	FILTER ELEMENT,FLUID	ARIMA(0,0,1)	0.06	0.31	4.975
012262103	SEMICONDUCTOR DEVICE,THYRISTOR	ARIMA(0,0,1)	0.32	10.14	31.938
013833883	GASKET	LINEAR TREND	0.70	1.15	1.653
002620167	ELECTRON TUBE	ARIMA(0,0,1)	38.51	69.29	1.799
000367087	COLLAR,THRUST	LINEAR TREND	30.86	45.27	1.467
001623823	SPACER	ARIMA(0,0,1)	12.04	51.53	4.278
009303254	SEAL RING,METAL	ARIMA(1,0,0)	348.99	478.42	1.371
009303257	RING,RETAINING	LINEAR TREND	208.22	307.35	1.476
009303259	RING-SE	LINEAR TREND	36.82	52.81	1.434
001260515	SPRING PACK,COUPLING	ARIMA(0,1,1)	588.63	1379.59	2.344
002730429	RING,PISTON	ARIMA(0,0,1)	7.91	38.81	4.907
008937703	SEAL,PLAIN ENCASED	ARIMA(0,0,1)	26.18	40.18	1.534
001434771	TERMINAL,LUG	ARIMA(0,0,1)	96.66	592.48	6.130
000979838	SEAL,PLAIN ENCASED	4-QTR SIMPLE MA	31.50	140.73	4.467
001759250	PUMP,DIESEL FUEL	ARIMA(0,1,1)	5.45	20.00	3.668
003644233	SLIP JOINT ASSEMBLY	ARIMA(0,1,1)	2.19	10.73	4.906

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
001346012	ELECTRON TUBE	4-QTR SIMPLE MA	7.64	21.93	2.871
001198812	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.44	0.89	2.039
001356045	RESISTOR,FIXED,COMPOSITION	LINEAR TREND	0.82	1.20	1.474
011436634	GASKET	LINEAR TREND	1.32	3.35	2.532
006183220	PACKING MATERIAL	LINEAR TREND	22.77	38.80	1.704
009846194	SCREW,MACHINE	ARIMA(0,0,1)	11.46	24.18	2.110
005421365	O-RING	4-QTR SIMPLE MA	74.42	182.03	2.446
008593742	RING SET,PISTON	ARIMA(0,0,1)	417.67	1563.76	3.744
010154486	FUSE,CARTRIDGE	4-QTR SIMPLE MA	2348.36	5642.37	2.403
001045755	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.14	0.95	6.567
011459071	GASKET	LINEAR TREND	0.35	0.60	1.681
011060118	RIBBON,INKING	ARIMA(0,0,1)	4.39	12.59	2.865
001741232	ROPE,FIBROUS	ARIMA(0,0,1)	33.08	125.74	3.801
006299712	PUMP,ENGINE PRIMING,HAND DRIVE	ARIMA(0,0,1)	5.20	18.99	3.653
001143834	ELECTRON TUBE	ARIMA(0,0,1)	0.06	0.30	5.517
007123203	AIR CLEANER,INTAKE	ARIMA(0,1,1)	0.17	0.62	3.594
011132083	O-RING	ARIMA(0,0,1)	40.97	121.00	2.953
003637395	MUFFLER,EXHAUST	ARIMA(0,0,1)	6.26	20.19	3.225
011576034	CIRCUIT CARD ASSEMBLY	LINEAR TREND	0.95	1.27	1.343
005840263	O-RING	LINEAR TREND	25.61	36.54	1.427
010463300	O-RING	LINEAR TREND	3.27	4.82	1.474
004503975	PACKING MATERIAL	ARIMA(0,0,1)	4.10	17.18	4.185
005885359	SEAL,PLAIN	4-QTR SIMPLE MA	71.25	859.63	12.065
003649789	SPRING	ARIMA(0,0,1)	21.98	117.24	5.333
004763872	CAMSHAFT,ENGINE	ARIMA(0,0,1)	1.21	2.03	1.678
00US02412	PLUNGER AND BARREL BEARING	ARIMA(0,0,1)	80.74	267.96	3.319
001560618	DIODE RECTIFIER	ARIMA(0,0,1)	1.19	7.81	6.540
002920580	O-RING	ARIMA(0,0,1)	19.74	50.07	2.536
001108879	SEAL,COMPRESSOR STATOR	ARIMA(0,0,1)	1.87	3.94	2.113
003534578	VALVE PLATE,COMPRESSOR	ARIMA(0,0,1)	1.37	7.33	5.333
006254959	OIL PUMP ASSY	ARIMA(0,0,1)	5.84	13.18	2.258
010097223	GASKET	ARIMA(0,1,1)	81.89	221.99	2.711
001979647	PACKING MATERIAL	ARIMA(0,0,1)	266.51	857.33	3.217
007266487	CONNECTOR,PLUG,ELECTRICAL	LINEAR TREND	0.43	0.63	1.482
010809652	GREASE,SILICONE INSULATED ELEC	ARIMA(0,0,1)	0.48	3.19	6.690
005112639	PARTS KIT,DIESEL ENGINE	LINEAR TREND	3.59	4.83	1.345
001287982	FENDER,MARINE	ARIMA(0,0,1)	3.92	5.30	1.354
002753156	RING BUOY,LIFESAVING	ARIMA(0,0,1)	868.84	2494.77	2.871
005276981	THERMOCOUPLE,IMMERSION	ARIMA(0,0,1)	431.45	1018.66	2.361
012598231	METHYL PURPLE ALKALINITY STAND	LINEAR TREND	1.14	1.73	1.510
001986190	O-RING	ARIMA(0,0,1)	2.44	4.78	1.962
002912764	WASHER,FLAT	ARIMA(0,0,1)	0.06	0.31	4.975
009457682	STANDARD CONDUCTIVITY SOLUTION	ARIMA(0,0,1)	40.94	122.58	2.994
011084274	VALVE,AIR 3-WAY	ARIMA(0,1,1)	2.92	10.17	3.485
011062218	VALVE,SOLENOID	ARIMA(0,1,1)	3.10	10.16	3.272

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
000762103	SEAL,PLAIN ENCASED	ARIMA(0,1,1)	2.70	6.99	2.591
008005243	SWITCH,LIQUID LEVEL	4-QTR SIMPLE MA	0.20	0.63	3.114
008449253	GAGE,PRESSURE,DIAL INDICATING	LINEAR TREND	1.26	1.99	1.581
001069344	RESISTOR,FIXED,COMPOSITION	ARIMA(0,0,1)	0.11	0.62	5.817
002804465	FUSE,CARTRIDGE	LINEAR TREND	7.54	10.50	1.393
004875998	SEAL	ARIMA(0,1,1)	20.22	80.69	3.990
004876319	SEAL	ARIMA(0,1,1)	4.12	17.30	4.199
006551508	SWITCH,TOGGLE	LINEAR TREND	0.83	1.42	1.711
002920570	O-RING	LINEAR TREND	3863.52	6135.09	1.588
003173288	DIAPHRAGM,VALVE,FLAT	ARIMA(0,1,1)	458.12	1124.83	2.455
006003236	PARTS KIT,SEAL REPLACEMENT,MEC	ARIMA(0,1,1)	677.96	2061.79	3.041
008735046	RING-SEP	LINEAR TREND	31.50	136.36	4.329
005899414	BEARING,SLEEVE	ARIMA(0,1,1)	390.37	1103.36	2.826
006176097	ELECTRON TUBE	LINEAR TREND	9.47	13.05	1.378
008049034	ELECTRON TUBE	ARIMA(0,0,1)	4.10	9.78	2.386
008218976	TRANSISTOR	LINEAR TREND	0.89	1.24	1.387
012028463	CABLE,POWER,ELECTRICAL	ARIMA(0,0,1)	60.91	128.29	2.106
013634992	ELECTRON TUBE	ARIMA(0,1,1)	3.40	9.55	2.806
001269733	SPRAY TIP,NOZZLE,FUEL INJECTOR	ARIMA(0,0,1)	144.61	606.65	4.195
002825031	RING,RETAINING	ARIMA(1,0,0)	4.09	6.73	1.645
012116370	BELT,V	ARIMA(0,1,1)	1.60	3.41	2.138
00US05438	LCD MODULE KEYBOARD	LINEAR TREND	1.42	2.38	1.681
006237111	VALVE,PNEUMATIC TANK	ARIMA(0,0,1)	0.11	0.62	5.817
007953332	GAGE,PRESSURE,DIAL INDICATING	ARIMA(0,0,1)	0.15	0.33	2.222
000742072	STRAP,TIEDOWN,ELECTRICAL COMPO	ARIMA(0,1,1)	1126.72	3125.34	2.774
002849455	FUSE,CARTRIDGE	LINEAR TREND	113.77	178.03	1.565
010339639	ADAPTER,CONNECTOR	LINEAR TREND	2.44	3.29	1.347
011793470	TRANSISTOR	ARIMA(0,0,1)	4.93	26.73	5.417
001670820	WASHER,FLAT	ARIMA(0,0,1)	8.21	25.02	3.046
002651088	O-RING	LINEAR TREND	0.17	0.29	1.652
004095617	DIODE	ARIMA(0,0,1)	1.93	3.48	1.803
011194303	CAPACITOR, TANTALUM	LINEAR TREND	1.98	3.08	1.552
011268439	CAPACITOR,FIXED,ELECTROLYTIC	4-QTR SIMPLE MA	35.55	135.63	3.815
006784019	CYLINDER HEAD,DIESEL ENGINE	ARIMA(0,0,1)	0.60	2.30	3.853
010777863	CRANKSHAFT,ENGINE	ARIMA(0,0,1)	1.70	6.62	3.883
005856663	O-RING	ARIMA(0,0,1)	425.25	1324.01	3.113
006413763	O-RING	ARIMA(1,0,0)	15.91	24.31	1.527
009086656	PUSH ROD,ENGINE POPPET VALVE	4-QTR SIMPLE MA	0.45	2.33	5.131
011203495	FILTER,FLUID	ARIMA(0,0,1)	0.31	0.69	2.213
011233300	O-RING	ARIMA(0,0,1)	9.37	44.12	4.710
001006151	BALL,BEARING	LINEAR TREND	7.11	10.10	1.421
009246981	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	0.62	1.19	1.934
00US19631	SPACER 10T01003-0000	ARIMA(0,0,1)	0.43	1.43	3.361
007776490	FUSE,CARTRIDGE	ARIMA(0,0,1)	3.97	19.88	5.007
002916713	GASKET	ARIMA(0,0,1)	5.39	29.09	5.396

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
000963015	GASKET	ARIMA(0,0,1)	70.12	237.29	3.384
007675574	ADAPTER,SPEEDOMETER-TACHOMETER	ARIMA(0,1,1)	0.35	1.05	3.007
005764468	PACKING,PREFORMED	ARIMA(0,1,1)	2985.36	9308.32	3.118
005593267	ION EXCHANGE COMPOUND	ARIMA(0,1,1)	260.74	794.38	3.047
013208823	PROPANE CARTRIDGE	ARIMA(0,0,1)	8.85	48.54	5.482
005513737	GASKET	ARIMA(0,1,1)	18.24	48.96	2.684
006204779	ROLLER,LINEAR-ROTARY MOTION	LINEAR TREND	0.17	0.29	1.653
001363909	TRANSISTOR	LINEAR TREND	10.04	13.73	1.368
003649951	PACKING,PREFORMED	ARIMA(0,0,1)	80.74	267.96	3.319
007534907	CHLORIDE INDICATOR	ARIMA(0,0,1)	0.28	1.58	5.558
011088901	SLEEVE,CONTROL	4-QTR SIMPLE MA	11.81	80.52	6.817
011220758	SEAT,PLUNGER	4-QTR SIMPLE MA	11.81	80.52	6.817
011293762	STANDARD CHLORIDE SOLUTION	ARIMA(0,0,1)	15.83	54.36	3.435
001651937	O-RING	ARIMA(0,1,1)	83.48	222.83	2.669
001695621	STARTER ENG ELECL 24V CW MDL 1	ARIMA(0,1,1)	0.25	1.07	4.333
006443039	SWITCH,TOGGLE	LINEAR TREND	0.35	0.60	1.681
010400214	SWITCH,FLOW	ARIMA(1,0,0)	0.41	0.72	1.734
012894238	TRANSISTOR	ARIMA(0,0,1)	31.29	141.45	4.521
000941663	PISTON,INTERNAL COMBUSTION ENG	ARIMA(0,1,1)	880.42	2260.11	2.567
004918643	SEAL,ROD	ARIMA(0,1,1)	13.16	35.55	2.700
001637231	DIODE,SWITCHING	4-QTR SIMPLE MA	3.53	14.12	3.997
003182223	MICROCIRCUIT,DIGITAL	ARIMA(0,1,1)	0.45	1.37	3.071
006250132	SEAL,PLAIN	ARIMA(0,1,1)	4185.15	12275.41	2.933
002270410	ISOPROPYL ALCOHOL,ACS	LINEAR TREND	0.43	0.63	1.482
010721977	HARDNESS BUFFER	ARIMA(0,1,1)	8.64	27.27	3.155
010721979	HARDNESS INDICATOR	ARIMA(0,1,1)	8.06	24.05	2.983
004956228	VALVE,GLOBE	ARIMA(0,0,1)	0.50	0.93	1.840
013124076	TRISODIUM ETHYLENEDIAMINETETRA	ARIMA(0,1,1)	153.46	444.04	2.894
001577951	EYEPIECEE	ARIMA(0,0,1)	0.15	0.68	4.638
002222564	ASBESTOS SHEET,COMPRESSED	ARIMA(0,0,1)	0.14	0.33	2.357
002447531	WIRE,NON-ELECTRICAL	ARIMA(0,1,1)	0.18	0.73	4.150
003644049	GASKET	LINEAR TREND	188.48	272.65	1.447
004052395	PACKING,PREFORMED	LINEAR TREND	0.22	0.31	1.432
006618665	BEARING,SLEEVE	ARIMA(0,0,1)	3.78	10.61	2.808
008807746	NUT,PLAIN,HEXAGON	ARIMA(0,0,1)	0.62	1.19	1.934
009971888	NUT,PLAIN,HEXAGON	ARIMA(0,0,1)	0.16	0.96	5.849
011158771	RECEIVER,RADIO	ARIMA(0,0,1)	0.09	0.34	3.905
005423362	REPAIR KIT,PIPE,EME	4-QTR SIMPLE MA	1237.78	5714.24	4.617
010614767	VALVE PLATE X SPRING SE	ARIMA(0,1,1)	0.49	1.56	3.198
011188236	BEARING,ROLLER,CYLINDRICAL	ARIMA(0,1,1)	13.86	42.23	3.047
012079687	SENSOR,HEAT	ARIMA(0,0,1)	48.67	754.53	15.503
002240868	PACKING MATERIAL	ARIMA(0,0,1)	4.45	15.71	3.531
002781226	ANODE,CORROSION PREVENTIVE	ARIMA(0,0,1)	1.40	6.31	4.506
001888499	ELECTRON TUBE	ARIMA(0,0,1)	68.29	148.29	2.171
014476111	MASTER CONTROL 2A29	ARIMA(0,0,1)	0.21	0.99	4.741

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
008505243	SEAL	ARIMA(0,1,1)	3.29	8.89	2.700
011453153	WASHER,FLAT	4-QTR SIMPLE MA	626.75	1399.69	2.233
000072003	CAPACITOR, TANTALUM	ARIMA(0,0,1)	0.69	1.68	2.445
000240128	TERMINAL BOX	ARIMA(0,1,1)	0.18	0.73	3.950
007936786	PUMP,COOLING SYSTEM,ENGINE	ARIMA(0,0,1)	1.36	4.23	3.121
003538291	FERRULE,WATER CYLINDER	ARIMA(0,0,1)	314.77	629.02	1.998
01F117735	FILTER	4-QTR SIMPLE MA	37.16	668.02	17.979
011079249	O-RING	ARIMA(0,0,1)	4860.27	12312.01	2.533
000566763	PISTON,COMPRESSOR	ARIMA(0,0,1)	302.04	1304.91	4.320
001000420	BATTERY,NONRECHARGEABLE	ARIMA(0,1,1)	92197.30	242337.50	2.628
001000475	BATTERY,NONRECHARGEABLE	ARIMA(0,0,1)	40114.50	60849.03	1.517
001201032	BATTERY,NONRECHARGEABLE	LINEAR TREND	4014.56	5839.02	1.454
001648754	BATTERY,NONRECHARGEABLE	LINEAR TREND	2367.93	3445.26	1.455
004516270	O-RING	LINEAR TREND	0.64	0.93	1.440
005421586	O-RING	ARIMA(0,1,1)	12.23	31.74	2.595
006905218	VALVE,REGULATING,FLUID PRESSUR	ARIMA(0,0,1)	2.07	9.29	4.489
007732782	COIL,ELECTRICAL	ARIMA(0,0,1)	3.64	13.19	3.621
009111794	SWITCH ASSEMBLY	ARIMA(0,1,1)	4.05	12.76	3.150
008151405	PIN,COTTER	LINEAR TREND	2.05	3.39	1.653
004511236	HEATING ELEMENT,ELECTRICAL,NON	LINEAR TREND	3601.22	5141.29	1.428
008734975	COLLAR-END PSTN	ARIMA(0,1,1)	0.95	4.51	4.728
008758249	SPACER-PSTN	ARIMA(0,1,1)	107.47	288.38	2.683
008060292	ELECTRON TUBE	LINEAR TREND	1.82	2.45	1.345
000434790	FUSE (1), CARTRIDGE	ARIMA(0,0,1)	0.86	3.49	4.058
010791647	SPLICE,CONDUCTOR	LINEAR TREND	0.43	0.63	1.473
003916135	VALVE,RELAYAIR	ARIMA(0,0,1)	17.26	35.49	2.056
006496532	VALVE,DELIVERY	ARIMA(0,0,1)	21.98	117.24	5.333
006799501	HANDSET	LINEAR TREND	10.48	13.81	1.318
00US01577	POWER SUPPLY	ARIMA(0,0,1)	0.15	0.68	4.471
008037305	RING,RETAINING	4-QTR SIMPLE MA	15.27	259.17	16.977
001609651	VALVE,CHECK	ARIMA(0,0,1)	0.42	7.17	16.960
001511718	BOLT,MACHINE	ARIMA(0,0,1)	0.25	6.93	28.019
013434758	TUBE LINE,OUTLET	ARIMA(0,0,1)	1.03	5.51	5.358
003642021	STOP,VALVE	ARIMA(0,0,1)	83.58	250.11	2.993
002435017	ELECTRON TUBE	ARIMA(0,0,1)	0.42	27.88	66.448
007637822	SCREW, FLAT HEAD	ARIMA(0,0,1)	32.04	1.28	0.040
001749463	BOLT,MACHINE	LINEAR TREND	0.89	6.90	7.717
002565362	VALVE,EXPANSION	ARIMA(0,0,1)	0.13	2.37	18.807
008405466	SEMICONDUCTOR DEVICE,DIODE	ARIMA(0,0,1)	0.84	7.02	8.325
008522369	SYNCHRO,RECEIVER-TRANSMITTER	ARIMA(0,0,1)	0.19	2.76	14.205
005996384	O-RING	ARIMA(0,0,1)	1.20	4.26	3.544
009590382	SCREW,CAP,SOCKET HEAD	ARIMA(0,1,1)	73.73	0.36	0.005
005825677	WASHER,FLAT	ARIMA(0,0,1)	0.11	0.36	3.361
000571421	FILTER ELEMENT,FLUID	LINEAR TREND	217.30	318.08	1.464
011841035	PARTS KIT,SOLENOID VALVE	ARIMA(0,1,1)	4.00	11.01	2.751

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
000383536	CONTACT,ELECTRICAL	ARIMA(0,1,1)	2.18	17.83	8.179
002730427	RING,PISTON	LINEAR TREND	73.13	234.12	3.202
003643753	LINER ASSEMBLY,CYLINDER	ARIMA(0,1,1)	10.84	26.94	2.486
003014887	CONTACT,ELECTRICAL	ARIMA(0,1,1)	8.18	29.52	3.608
003794508	BRUSH,ELECTRICAL CONTACT	ARIMA(0,0,1)	9.42	43.25	4.592
000189661	TRANSISTOR	4-QTR SIMPLE MA	2.06	27.81	13.483
004914980	HOSE,NONMETALLIC	ARIMA(0,1,1)	0.20	1.20	6.094
000048293	PART KIT,LUBRICANT PUMP	ARIMA(0,1,1)	0.34	1.30	3.836
005827116	GASKET SET	ARIMA(0,1,1)	0.28	4.14	14.661
002259054	O-RING	ARIMA(0,0,1)	1.70	26.46	15.580
002725696	NUT,PLAIN,HEXAGON	4-QTR SIMPLE MA	695.89	12843.89	18.457
009955382	O-RING	4-QTR SIMPLE MA	4.69	72.46	15.458
012393869	TRANSFORMER-RECTIFI	ARIMA(0,0,1)	0.10	0.39	4.084
006156762	BOOT,DUST AND MOISTURE SEAL	ARIMA(0,1,1)	1.40	10.73	7.646
010043608	CYLINDER SLEEVE	ARIMA(0,1,1)	0.24	1.13	4.788
001668403	O-RING	ARIMA(0,0,1)	2.27	41.54	18.278
005489165	FUSE,CARTRIDGE	4-QTR SIMPLE MA	120.36	332.36	2.761
001169969	ELECTRON TUBE	ARIMA(0,0,1)	8.35	16.86	2.020
01F135638	O-RING	ARIMA(0,1,1)	3.51	51.24	14.599
01F135809	AUTO DRAIN	ARIMA(0,1,1)	35.40	94.17	2.660
009070950	SEAL ASSEMBLY,SHAFT,SPRING LOA	ARIMA(0,1,1)	0.36	9.57	26.712
012523813	VALVE ASSEMBLY	ARIMA(0,1,1)	21.69	63.42	2.924
010284533	COUPLING HALF,QUICK DISCONNECT	ARIMA(0,1,1)	1.03	2.65	2.567
006650513	FUSE,CARTRIDGE	4-QTR SIMPLE MA	21.94	77.43	3.529
010372883	ACTUATOR,DAMPER VEN	ARIMA(0,1,1)	0.90	2.20	2.459
010912655	HEATING ELEMENT,ELECTRICAL,IMM	ARIMA(0,0,1)	0.11	0.36	3.361
006411697	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	272.88	660.92	2.422
010833063	SEAL,PLAIN ENCASED	ARIMA(0,1,1)	15.64	40.59	2.596
013387782	GASKET,SPIRAL WOUND	4-QTR SIMPLE MA	301.38	1297.81	4.306
009873730	BEARING,BALL,ANNULAR	ARIMA(0,1,1)	2.88	9.87	3.424
010614443	LOCK,VALVE SPRING R	ARIMA(0,0,1)	0.17	0.68	3.898
010408666	GASKET,SPIRAL WOUND	ARIMA(0,1,1)	52.56	141.62	2.694
002440193	RUBBER SHEET,SOLID	ARIMA(0,1,1)	0.90	4.73	5.236
002774653	TUBE METALLIC	ARIMA(0,0,1)	89.78	181.29	2.019
002774655	TUBE METALLIC	ARIMA(0,0,1)	1160.88	2342.92	2.018
003949627	COUPLING,PIPE	ARIMA(0,0,1)	0.77	1.56	2.017
004830695	VALVE,GLOBE	ARIMA(0,1,1)	26.85	52.71	1.963
005425261	TEE,PIPE	ARIMA(0,0,1)	0.19	0.39	2.017
005425361	TEE,PIPE	ARIMA(0,0,1)	7.50	11.23	1.497
005425399	TEE,PIPE	ARIMA(0,0,1)	0.19	0.39	2.017
005425951	NUT,UNION	ARIMA(0,0,1)	49.41	99.68	2.017
005425959	TAILPIECE,UNION	ARIMA(0,0,1)	49.41	99.68	2.017
010764529	VALVE,BALL	ARIMA(0,0,1)	0.19	0.39	2.017
011074164	NUT,UNION	4-QTR SIMPLE MA	4.27	114.49	26.840
012000579	STUD,PLAIN	ARIMA(0,1,1)	0.21	1.40	6.665

NIIN	ITEM NAME	MODEL NAME	MSE PROPOSED	MSE ACTUAL	MSE RATIO
009542159	TRANSISTOR	ARIMA(0,1,1)	32.41	173.69	5.359
002401973	PACKING MATERIAL	4-QTR SIMPLE MA	35.77	225.05	6.292
01F148069	DIAPHRAGM	ARIMA(0,1,1)	8.26	25.51	3.090
007200527	CONNECTOR,RECEPTACLE	ARIMA(0,0,1)	4.18	13.34	3.195
008791519	CONNECTOR-SWITCH	LINEAR TREND	0.86	1.24	1.445
008821794	SULFUR HEXAFLUORIDE,TECHNICAL	ARIMA(0,0,1)	240.44	681.53	2.835
00US16988	HEATSINK PWB ASSEMBLY	ARIMA(0,0,1)	1.67	5.36	3.216
011796408	PILOT ASSEMBLY,VALVE	ARIMA(0,0,1)	0.15	0.70	4.768
009797703	SEAL	4-QTR SIMPLE MA	15.28	62.50	4.090
008455674	GASKET AND SEAL SET	ARIMA(0,1,1)	0.18	0.70	3.864
013102625	AMPLIFIER,RADIO FREQUENCY	ARIMA(0,0,1)	0.45	1.08	2.418
006060633	PLUG,TUBE REPAIR	ARIMA(0,1,1)	16.35	71.59	4.378
001091344	BEARING,BALL,DUPLEX	ARIMA(0,1,1)	28.84	101.68	3.526
008177864	CONTACT,ELECTRICAL	ARIMA(0,0,1)	9.41	19.60	2.083
010466537	STUD,CONTINUOUS THREAD	ARIMA(0,1,1)	27.84	101.63	3.650
010483842	STUD,CONTINUOUS THREAD	ARIMA(1,0,0)	38.94	131.50	3.377
004204944	COMPRESSOR UNIT,REFRIGERATION	ARIMA(0,1,1)	0.13	0.34	2.585

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